CFTRI LIBRARY BIBLIOGRAPHICAL SERIES

PART · I

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH INDIA

CENTRAL FOOD TECHNOLOGICAL
RESEARCH INSTITUTE
MYSORE-2A, INDIA

CFTRI LIBRARY BIBLIOGRAPHICAL SERIES-1

Select List of Books on Food Science and Technology in C.F.T.R.I. Library

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No. 1.

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
MYSORE-2A

PREFACE

The need for a fairly concise list of books covering most, if not all, aspects of food science and technology has been constantly felt by many users of the Library. One such list had been prepared by our ex-Librarian about ten years ago and though short, it proved to be of great use to students as well as research workers and Librarians in other institutions.

This present list has been compiled from the card catalogue maintained in the library and contains, almost exclusively, books in the English language. The titles have been arranged in classified order according to subject; the provisional depth schedule for food technology (developed in the library) has been used for this purpose. Each entry consists of class number, author, title of book, name of the publisher, year of publication, and price. Both an author and a subject index have been provided at the end.

The library staff, in particular Shri S.B. Chennakeshava Das and Sri S. V. Sangameswaran have prepared this list with a great deal of diligence and care, and it is hoped that their labour will be rewarded by the complete satisfaction felt by the users.

K.M. Dastur
Chairman,
Library Committee

F85,3 Food Technology

1. F85,3"k
LUCK (E), Ed. English-German dictionary of food technology 1963.
Brandstetter Verlag (Wiesbaden). DM 20.00

2. WALDO (M). Dictionary of International Food and Cooking terms, 1967.
Macmillan (New York), $ 7.95

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CLOTTEY (JA) and EYESON (KK),Ed. Proceedings of the first seminar of food science and technology in Ghana; sponsored jointly by the Food Research Institute and the United Nations. Food Research and Development Unit, Accra, May 22-23, 1967 (1968).

4. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (ROME) World food congress: (Report), held on 4 to 8 June 1963 at Washington, D.C. 1963. Rs. 4.25

5. LEITCH (JM), Ed. Food Science and Technology: (Proceedings of the First International Congress of Food Science and Technology London, September 18-21, 1962). Vol.2,3,4(1965), Vol.5 (1967).
Gordon & Breach Science Publisher, New York.

6. NATIONAL INSTITUTE OF SCIENCES OF INDIA, New Delhi. Proceedings of symposium on food needs and resources held at Mysore on May 16 and 17, 1961, 1962.
(National Institute of Sciences of India Bulletin No.20).

7. SECOND INTERNATIONAL CONGRESS OF FOOD SCIENCE AND TECHNOLOGY. Warszawa Poland, 1966. (Abstract of papers).

8. TILGNER (DJ) and BORYS (A), Eds. Proceedings of the 2nd International Congress of Food Science and Technology, Aug.22nd-27th 1966. Warszawa 1967. Rs. 90/=

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Advances in food research, Vol.1(1948), Vol.17(1969). Academic.

10. BATE-SMITH (EC) and MORRIS (TN). Food Science, 1952. Cambridge University press, £ 2/-

11. BORGSTROM (G). Principles of food science, Vols. 1 and 2, 1968.
MacMillan $ 12.95

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14. CFTRI, Mysore.
Some aspects of food technology in India, 1959.

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Five technical reports on food and agriculture, 1945.

16. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome. Report of the International emergency food committee for the Council of FAO at its second session, 1948.

17. HAMPE (EC) and WITTENBERG (M). Lifeline of America. Development of the food industry, 1964.
McGraw Hill. $ 6.95

18. HAWTHORN (J) and LEITCH (JM), Eds. Recent advances in food science, Vols. 1 and 2 (1962), Vol.3 (1963).
Butterworths 70 sh

19. LYALL (N). Some savoury food products, 1965. Edited and Revised.
Food Trade Press (London). Gratis.

20. McCARRISON (R). Food (English-Edn) Edn. 2, 1956.
MacMillan, (Madras). Rs. 1.75

21. PECKHAM (CC). Foundations of food preparation, 1964.
Macmillan Co. (New York). $ 7.50

22. PETERSON (MS) and TRESSLER (DK), Eds. Food Technology the world over, Vol.1 (1963), Vol.2, (1965).
AVI $ 16.00

23. PRESCOTT (SC) and PROCTOR (BE). Food Technology, 1937.
McGraw-Hill. Rs. 22/=

24. PYKE (M). Food science and technology 1968. Ed.2 (Rev. & Enlarged).
John Murray (London). 35 s

25. SMITH (DB) and WALTERS (AH). Introductory food science, 1967.
Classic Publications Ltd., London. 25 s.

26. VON LOSECKE (HW). Outlines of food technology, 1949.Ed.2.
Reinhold. Rs. 38/=

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F85,3&aCM96 Food <u>in relation to</u> Radioactive materials

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UNIVERSITY OF SAO PAULO. Proceedings of the 1st Brazilian symposium on food and nutrition. Siban Campinas 18 to 24 July 1965.

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Technical aid to food industries, 1954 (Proceedings of the symposium held at the CFTRI, Mysore on 5th and 6th Feb. 1953).
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Leonard Hill (London). 210 s.

F85,3:(D) Food Engineering

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BRENNAN (JG) and others. Food engineering operations, 1969.
Elsevier (Amsterdam). 110 sh

33. CHARM (SE). The fundamentals of food engineering 1963.
AVI $ 25.50

34. CLARKE (RJ). Process engineering in the food industries, 1957.
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35. PARKER (ME) and others. Elements of food engineering, Vol.1 (1952), Vols. 2 and 3 (1954).
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36. SLADE (FH). Food processing plant, Vol.1, 1967.
Leonard Hill Books, London. 110 s.

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CLAYTON (W). Colloid aspects of food chemistry and technology 1932.
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38. JACOBS (MB) ed. Chemistry and technology of food and food products, Vols. 1-3, Ed.2, 1951.
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39. MEYER (LH). Food Chemistry, 1960.
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40. SCHORMULLER (J), Ed. Handbuch der lebensmittelchemie (German).
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47. INGRAM (M) and ROBERTS (TA), Eds. Botulism 1966 (proceedings of the fifth International Symposium on food microbiology, July 1966) 1967.
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48. STUMBO (CR). Thermobacteriology in food processing 1965, UK Edn.
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GOLDBLITH (SA) etc. Introduction to the thermal processing of foods, Vol.1, 1961.
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ASSOCIATION OF OFFICIAL AGRICULTURE CHEMISTS (Washington DC).
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73. JOSLYN (MA). Methods in food analysis, 1950.
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74. LEES (R). Laboratory handbook of methods of food analysis, 1968.
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HMSO (London) 30 sh.

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Wiley. Vol.1(1932),Vol2.(1935),Vol.3(1937) and Vol.4(1939
$ 44.50(4 vols.)

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Academic Press (New York) $ 10.00

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Research on food preservation in the UK, 1954.
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F85,3:xP,FP6 Food infra-red irradiation

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F85,3;a06:x5 Food quality control

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F85,3;eF31 Food sensory evaluation

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SCHULTZ (HW(and others, eds. Symposium on foods: Lipids and their oxidation (Second in a series of symposium on food held at Oregon State University), 1962.
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Chemical used in food processing, 1965.
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SCHROETER (LC). Sulfur dioxide: applications in foods, beverages, and pharmaceuticals, 1966.
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DACK (GM). Food poisoning 1949, Rev. 1949.
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Toxicants occurring naturally in foods, 1966.
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F85,3;F2 Food,Microbial toxins

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Microorganisms in foods: Their significance and methods of enumeration, 1968.
University of Toronto Press, Canada. $ 12.50

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Food and Nutrition Board, Food Protection Committee, Washingt DC. Evaluation of public health hazards from microbiological contamination of foods, 1964.
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HERZKA (A) and PICKTHALL (J). Pressurized packaging, 1958
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363. BOYD (J). Biscuits plain and fancy, 1949.
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Standard methods for the examination and analysis of milk
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F85,3C-OF8 Milk, pasteurization

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50 cents each.

414. AMERICAN MEAT INSTITUTE FOUNDATION (CHICAGO). Proceedings of the tenth, eleventh. fourteenth and sixteenth conference, 1958, 1959, 1962 and 1964 resp. held at University of Chicago. 50 cents each.

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F85,3Z481;e Coffee chemistry

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483. FOSTER (C). Home wine making, 1969.
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487. VALAER (P). Wines of the world, 1950.
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490. HEMPHILL (R). Herbs and spices, 1966.
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491. PARRY (JW). Spice handbook, 1945.
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New York $ 5.00

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F85,3ZZb Pickle

497. BINSTED (R) and others. Pickle and sauce making 1962.
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Jenkins £ 0.3.6

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Rs. 3/=

502. SARSON (H). Home pickling 1947.
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F85,3ZZb:xP Pickle preservation

503. HARRIS (Mrs. Flora). Pickling and preserving, 1951.
Abelard Press. $ 2.50

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CFTRI LIBRARY BIBLIOGRAPHICAL SERIES-2

A Select Bibliography

on

Refrigerated, Frozen, Cold-Stored Fish

1 9 7 0

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CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE LIBRARY

M Y S O R E

NOTE

The Main-Entry cards prepared from Monthly Documentation List for Food Technology are being stored in the catalogue cabinet from August 1966 in classified sequence. The entries for this select Bibliography have been collected from the stored cards.

The Bibliography is divided into two parts: The first is an Alphabetical Index of subjects and authors and the Second part is a list of articles arranged in a classified sequence.

The Bibliography has been complied as per request received from a scientist by V. S. Susheelamani.

S.V. Sangameswaran
Scientist, Library.

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L

1 N66 BANKS (A). Refrigeration (chilling and freezing) as applied to fish. Bull Intern Inst Refr 1966;33;Suppl.

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2 N65 LAMOTIN (J). On board freezing fish with the view to making fresh fish available to the markets in tropical countries. Bull Intern Inst Refrig 1965;205.

3 N66 ROACH (SW) and others. Partial freezing as a means of preservin various species of groundfish. J Fish Res Board Can 23;1966; 701.

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8 N69 JADHAV (MG) and MAGAR (NG). Preservation of fish by freezing and glazing bacteriology of fresh, frozen and glazed fish. Fish Tech 7(1);1970;86.

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F85,3Zn-OC3;963;b12;a86 Fish, Cold stored, Fatty acid Quantity,

14 N69 JONAS (REE). Effect of magnesium sulphate and cryoprotective agents on free fatty acid formation in cold stored fish muscle. J Fish Res Board Can 26(8);1969;2237.

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16 N69 AYYAPPAN PILLAI (S). Role of refrigeration in fish processi industry. Indian Food Packer 23(3);1969;18.

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Egg and Egg Products

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M Y S O R E.

As quite a number of reference enquiries were received on eggs and egg products it was judged useful to bring out a brief bibliography on the subject. The bibliography presented here has been compiled from the entries in the Documentation List for Food Technology during the period 1966 to 1970.

The bibliography lists 144 papers from 41 journals; the references are arranged in classified order, and author and subject indices are also provided at the end. The compilation work has been done by Sri S.V. Sangameswaran and Miss V.S.Susheelamani.

As similar bibliographies on other subjects are being planned, readers and users of this list are requested to kindly send their comments and suggestions to the CFTRI Library.

K.M. Dastur
Chairman, Library.

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No. 4

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE

MYSORE-2A., INDIA

CFTRI LIBRARY BIBLIOGRAPHICAL SERIES - 4

A Select Bibliography on Pollution (1965-1970)

1971

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
MYSORE

FOREWORD

Environmental pollution caused by various industrial and agricultural operations has attained such dimensions that there is public alarm in the industrially developed countries. Some time ago, Tokyo was covered by a blanket of smog which caused acute distress to millions of people, and was responsible for number of deaths. There was also a report that as much as 0.51 ppm of insecticidal chemicals were found in the milk of Japanese mothers. Such a situation has naturally aroused demands for urgent remedial measures, and many studies have been undertaken to devise methods of pollution control.

This annotated bibliography has been compiled in order to acquire a synoptic overview of the subject and learn from the experience gained in other parts of the world.

The bibliography is by no means exhaustive, and is confined to the literature available in the CFTRI Library. The entries cover the period 1965-70 and have been collected from 7 abstracting or indexing journals and 33 primary journals. Most of the abstracts have been copied from the journals themselves. It was considered undesirable to change an abstract, unless the original paper was also available for consultation; that is why some of the abstracts are very long.

It may be noted (i) that only a very few, isolated studies have been reported from India; and(ii) that there are only 7 papers dealing with pollution caused by food industries. The problem of pollution in some of our metropolitan areas is becoming serious and should be tackled as early as possible.

This bibliography has been prepared by Miss V. S. Susheelamani and Shri S.V. Sangameswaran with the assistance of Shri Naganna in the initial stages. Some of the abstracts have been written or edited by Sri K.M. Dastur.

B.L. Amla
Chairman
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Consultancy and
Extension.

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A SELECT LIST OF BIBLIOGRAPHY ON POLLUTION
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POLLUTION

1. **SHARMA** (AK). Focus on pollution. Science & Culture 37(2);1971; 61-65.

   In this leader, the author discusses in a general way the studies and reports made in India in the last year or two and summarises fourteen important measures that have been recommended to minimize pollution. He emphasises that the entire success of pollution control depends on the integrity of our citizens with full regard on externalities.

2. FURKERT, HERBERT. Two routes to sulfuric (acid) prove tough on pollution. Chem Eng (NY) 76(1);1969;70-2 (Eng) [Chem Abstr 70;1969;88 Ab. No. 69638b).

   The Bayer and Chemiebau processes for the production of H_2SO_4 are described with flowsheets. Both processes involve multistage catalytic conversion of SO_4 to SO_3, and 2-Stage absorption of SO_3. Although both processes require higher investment than the conventional single-stage absorption process, they have the advantages of higher yields and significantly lower emissions of SO_2 and SO_3 to the atm.

3. HYGIENE (PL). Pollution and infection. Architects J 149;1969;529.

4. NELSON-SMITH (A). Records of pollution. Environmental Pollution 1(1);1970; Nature 227(5260);1970;864. [Cormer Fish 23(12); 1970;30(9.19].

   This new journal will specialize in contributions dealing with the social, economic, and engineering aspects of enviromental pollution.

5. ZUTSHI (AK). Pollution. Science & Culture 37(2);1971;65-68.

   Indicates the effects of different types of chemical pollutants (SO_2, CO, DDT, Endrin), physical pollutants (noise, dust, oil, smoke) physico-chemical pollutants (CO_2, water vapour) and thermal pollutions. The concentrations of some of these over Bombay are compared with the All-India and world averages in a table. Emphasises the need for preventive action against such potential dangers.

6. EIPPER (AW). Pollution problems, resource policy and the scientist. Science 169(3940);1970;11-15 [Commer Fish 23(11);1970;21(9.19)].

The author describes some of the prominent characteristics of modern water pollution problems and the resources manag principles that must be recognized in dealing with them. He also discusses the implication of these problems and principles to the scientists' role in helping to preserve the quality of the environment. A recent case (a proposed power plant on Cayuga lake, New York) is used to illustrat certain aspects of present-day resource management contro_ versy. He suggests nine principles to guide our dealings with natural environments and the scientists' role in implementing them. These principles are: (i) decisions on management of a natural resource must be basically public ones; (ii) the widest possible variety of applicable criter should be used for estimating values and determining priori ties--the cost effectiveness approach is inadequate (iii) f and open communication is essential; (iv) impending polluti problems should be corrected before they start; (v) because everyone has the right to a high-quality environment, the "burden of proof" must be on the potential polluter, not on the public; (vi) all of us must pay the cost; (vii) each alternative to achieving a program objective (that involves a natural resource) must be thoroughly considered; (viii) future use of the environment must be in the recycle context of perpetual renewal and reuse (not the old pattern of use and discard); (ix) we must practise means of preventing poll -tion.

SOIL, POLLUTION

7. ALEXANDER (M). Breakdown of pesticides in soils. Publ. Amer. Ass Advanc. Sci. No.85;1967;331-42 (Eng). [Chem Abstr 71;1969; 223 Ab No. 76679u].

In analyzing the breakdown of pesticides in soil it is essential to know the agent of inactivation, environmental factors influencing the rate of breakdown; fate of other substances entering the soil, and the reasons why a slight modification in the structure of a readily degradable mol. makes it resistant. Such ecological and biochemical experime -tation will lead to a lessening of the extent of soil pollution and an increase of the benefits of pesticides to agriculture and public health.

8. PATIL (KC) and others. Degradation of endrin, aldrin, and ddt by soil microorganisms. Appl Microbiol 19(5);1970;879-881 [Commer Fish 23(9);1970;32(9.19)].

Chlorinated hydrocarbon insecticides have been used exten_ sively throughout the world and, as a result, they and their metabolities have accumulated in the organisms. The purpose of the present study was to test 20 soil organisms f ability to degrade endri

nyl)-1-chloro-2,2,2-trichiloroethane], Baygon (O-isopropoxyphenyl-N-methyl carbamate), and r-BHC (gamma isomers of benzenehexachloride). The microorganisms tested were: Trichoderma viride 12 and 41; Pseudomonas spp. 27,33,94,103, 105,117,138,land 265; Micrococcus 204; Arthrobacter sp. 278; Bacillus spp. 453, 459, and 461; and unidentified species 96, 108, 158, and 202. Matsumura and Boush described the isolation of these organisms (Science 156, 959-961 [1967]).

All the isolates were able to degrade DDT and endrin and 13 of them were able to degrade aldrin. None of the organisms was able to degrade Baygon or γ-BHC. [1 figure, 1 table, 15 references].

9. VOERMAN (S) and BESEMER (AFH). Residues of dieldrin, lindane, DDT and parathion in a light sandy soil after repeated application throughout a period of 15 years. J Agri Food Chem 18(4);1970;717-19 [Commer Fish 23(10);1970;25(9.19)].

As part of an experiment to determine the influence of pesticides on the yield of crops, the authors examined the persistence of pesticides in the cultivated soil. From 1953 on through a period of 15 years, dieldrin, lindane, DDT and parathion, at two concentration levels, were sprayed on crops several times a year. In addition, the soil was treated with the insecticides once a year. Soil samples were taken after 15 years in layers of 10 cm (3.9 inches) thickness to a depth of 60 mm. The soil was light sandy.

DDT and dieldrin were more persistent than lindane. Parathion disappeared relatively soon. Below 20 cm in depth of soil, traces of only dieldrin and DDT were found.

OIL POLLUTION

10. DECKER (A). Rheinwerft's answer to oil pollution. Dock and Harbour Authority 50(586);1969;200-202 [Commer Fish 23(8); 1970;26(9.19)].

The "Rheinwerft Oil Removal Unit" has proved successful in eliminating oil slicks in confined waters. The device, basically consists of three circular pontoons disposed and strutted triangularly. Inside the triangle is a floating basin in which the water level is lowered with a pump. The pump is housed on one of the pontoons. The floating oil flows into the artificial well so created. A second pump located on another pontoon draws off the oil from the artificial well.

THERMAL POLLUTION

11. KRENKEL (PA) and PARKER (FL). Proceedings of the national symposium on thermal pollution. Vanderbilt Univ Press Nashville, Tennessee 37203 (n.d). [Commer Fish 23(4);1970; 25(9.19)].

The National Symposium on Thermal Pollution, jointly sponsored by the Federal Water pollution Control Administration and Vanderbilt University, was held in two sessions, the first, on Biological Aspects of Thermal Pollution, in Portl Oregon, June 3-5 1968; the second, on Engineering aspects o Thermal Pollution, in Nashville, August 14-16, 1968. The proceedings of these two sessions are available in two volumes from the Vanderbilt University Press for $ 7.95 each.

Biological aspects of thermal pollution (xx + 407 pp. 77 illustrations, index) contains the following chapters: keynote address: effect of thermal loading of water ways; remarks on the effects of heated discharges on marine zooplankton; aspects of the potential effect of thermal alteration on marine and esturine benthos; banquet address; developing thermal requirements for fresh water fishes; some effects of temperature on fresh water algae; the effects of heated discharges on fresh water benthos; theoretical considerations of the effects of heated effluents on marine fishes; effects of heated discharges on anadronous fishes; effects of heated discharges on fresh water fishes in Britain; research needs for thermal pollution control; discussio

Engineering aspects of thermal pollution (xxi + 351 pp., 105 illustrations, Index) contain the following chapters: Keynot address; putting waste heat in its place; ecological changes of applied significance induced by the discharge of heated waters; water quality standards for temperature; the cooling of riverside thermal power plants; mechanics of condenser water discharge from thermal power plants; modeling of heated power discharges; the horizontal travelling screen; banquet address; design and operation of cooling towers; economic consideration in thermal discharge to streams; summary and status of the art; research needs for thermal pollution control; discussion.

12. KRENKEL (PA). Biological aspects of thermal pollution. Vanderbit Univ Press: Nashville, Tenn) 1969;407 [Chem Abstr 72;1970;254 Ab. No. 114773w).

ENVIRONMENTAL POLLUTION

13. BROCK (TD). Microbiology of thermally polluted environments. Nuclear Sc Abstr 24(6);1970;1128 (Ab No.11359) [Commer Fish 23(9);1970;32(9.19)].

14. BRUCH (CW). Voluntary private behaviour as a means to reduce consumer health hazards and environmental pollution. US Govt. Res Develop Rep 70(8);1970;127 [Commer Fish 23(9);1970;35(9.19)].

The document is concerned with how much reliance the public should place on voluntary private behavior to protect the environment and the consumer, and whether the voluntary activities of industry possess the potential to obtain necessary changes in environmental quality and to protect the consumer from health hazards. The study examined thenature of the regulatory process as a legal and administrative tool, the role of incentives and economics in pollution control, and a qualitative estimation of achievements of voluntary private behavior in the reduction of health hazards associated with foods, drugs, and cosmetics, and the indirect health hazards from air, water and solid wastes pollution.

15. CEQ off to an ambitious start. Environ Sc & Tech 4(7);1970;545-6 [Commer Fish 23(12);1970;32(9.19)].

The Council on Environmental Quality (CEQ) has the following assigned functions: to report annually on the condition of the nation's environment, to report environmental trends, to coordinate the environmental programme of all Federal agencies, to evaluate all Federal progress from the standpoi of their environmental impact, to see that environmental factors are properly considered by decision makers, and to propose policies and programs to the President. It is too early, says the author, to judge the success of CEQ in discha-ging these functions. But if this Council has as much influence on environmental decision makers as the Council of Economic Advisors has on financial decision makers, this new experiment in government will be more than worthwhile. Of the groups that have been formed to help CEQ is one on tax policy (this group will try to answer such questions as: Do present tax policies encourage activities undesirable in respect to the environment? How should the tax structure be modified to encourage individuals and group to meet environmental goals?) and one on law and administrative procedures (not only will this group consider case studies and analyze environmental legal problems, it will assist in developing model laws and administrative regulations for use by state and local government).

16. DEAN (RB). Ultimate disposal of waste water concentrates to the environment. Environ Sci Technol 2(12);1968;1079-86 (Eng). [Chem Abstr 70;1969;237 Ab No. 40508y].

Advanced treatment of waste water is basically the sepn. of a valuable product (water) from its pollutants. The residue of substances which remains normally has no pos. economic value, and must be degraded. Disposal at or near the shoreline has the effect of increasing the

breeding and survival, or harmful, as in the case of unwanted blooms of algae and microscopic organisms. The fuel value of dry sludge is comparable to that of low-graded coal, and can be measured accurately in a bomb calorimeter. Aerobic digestion stabilizes solids against subsequent putrefaction and retains most of the nutrients and other materials. One convenient way to speed up the pptn. of phosphates is to increase the pH by adding hydrate of lime. At high pH, Al hydroxide redissolves to form allu-minate ions. Phosphate ions, formed by the dissoln. of some of the Al phosphate at high pH, can be pptd. as appetite by Ca. High rate biol. treatment usually leaves most of the N in the form of NH_3. Extended aeration converts nearly all of the NH_3 to nitrates. The large vol. of air necessary to remove NH_3 make a preconcentration step desirable. Some of zeolite minerals selectively adsorb ammonium ions. Cyanides and Se are found in surface waters They are difficult to control in dil. solns. and should not be permitted to enter municipal sewers.

17. IRVING (GW). Agricultural pest control and the environment. Science 169(3938);1970;1419-1424 [Commer Fish 23(11);1970; 22 (9.19)].

The control of agricultural pests and the protection of our environment from pollution create conflicting problems. Because agriculture must maintain and increase the efficiency of production to feed the increasing millions of people and animals in the world, continuing and even more effective control of pests is required. We can afford no longer to give up a substantial portion of our potential food supply to pests and crop diseases. At the same time as populations increase and people must move closer together, protection of the environment becomes more acute. We must have an effective program for protecting our food supply but at the same time preserve the quality of the environment.

18. KELLEHER (WJ). Environmental surveillance around a nuclear fuel reprocessing installation, 1965-1967. Radiol Health Data Re 10(8);1969;329-39 [Commer Fish 23(8);1970;25(9.19)].

Data are given to show the levels of radioactivity of air, milk, liquid wastes, watersheds, silt, deer, and fish in the areas surrounding a nuclear fuel reprocessing plant that began operating in the spring of 1966. The levels of ^{131}I, ^{137}Cs, and ^{90}Sr in milk did not change detectably during the 3-yr. test period. However, the levels of ^{137}Cs in the soft tissues of deer and of ^{90}Sr in fish increased significantly.

The author suggests that the changes in the soft tissues of the deer were probably due to the deer's drinking contaminated water. He also suggests that the high levels of radionuclides in the deer and the fish may be enough to cause health hazards.

19. SMITH (DB). Growth potential for isotope applications in environmental and oceansciences. Atom No.148;1969;48-51 (Eng). [Chemical Abstr 71;1969;458 Ab No. 8784v].

A review is given of isotope applications to hydrology [Tracing of ground water, ^{14}C measurements, ground water satisfaction), oceanography (coastal and off-shore sea bed movements, sea bed in situ analyses, coastal water pollution), and meteorology (tropospheric air motion, storms and anticyclones, atm. pollution).

20. WEST (TS). Some analytical aspects of environmental pollution an introduction. Lab Pract 20(1);1971;21.

In this and subsequent papers on some analytical aspects of environmental pollution, Laboratory Practices will deal with some of the problems, solutions to problems and questions posed by the analytical assessment of environmental pollution. The whole area of this subject is so vast that necessarily only a limited number of topics can be discussed. In this introduction some of the basic requirements of the analytical methods are reviewed.

21. WILSON (BR). Environmental problems, pesticides, thermal pollution, and environmental synergisms. 1968;183. [Chemical Abstr 70;1969;209 Ab No. 31463c].

AIR POLLUTION

22. Airborne contamination. Food Eng 39(9);1967;128-130, 132.

The particles which may contaminate the air in a food processing plant are given and their sources are mentioned. Methods used for preventing access of these to the processing regions are discussed.

23. Air pollution, proceedings of the first European Congress on the influence of air pollution on plants and animals. New Scientist 44(679);1969;567-8 [Commer Fish 23(3);1970;19(9.19

This publication contains some 36 papers read at a congress sponsored by the Netherlands Government and the Council of Europe and organized by the Agricultural University, Wageningen (Netherlands). Among the pollutants that contribute to the biological effects of air pollution, fluorine, photochemical smog, sulfur dioxide, and some less frequently encountered pollutants were discussed. As a rule, once the cause of pollution damage has been identified, a means of control can be devised. Whether it can be enforced, however, is another problem, for since many instances of pollution damage in one country are the result of emissions in another, successful control depends

24. ALIKONIS (JJ) and ZIEMBA (JV). Air pollution - Clean it up. Food Eng 40(7);1968;71-6.

Some of the food processing plants which are responsible for air pollution are mentioned. These include fish meal drying plants, grinding plants which produce dust, plants producing smoke and trucks which produce carbon monoxide in the exhaust gases. The first step in preventing this pollution is to examine the nature of the pollution. In many cases the products which cause pollution should be recovered and sold at a profit. Methods for controlling pollution are considered.

25. Killing smells. Times Rev Ind Tech 5(8);1967,46

The use of ozone, generated when the fan of the air conditioning unit is operating, for purifying the air in a food processing or storage unit is considered briefly. The maximum concentration of ozone in the air is controlled to a low level.

26. LICHTENSTEIN (S). Air pollution, research. Air pollution investigation (Warren spring laboratory) Investigating air pollution (US National Bureau of Standards) Chem Process 13;1967;102-5.

27. LONGSTRETH (T). Air pollution and the Engineer. ASHRAE J 13(3);1971;32.

A plea for effective collaboration between engineers on the one hand and the general public, elected officials, industri and business leaders on the other to make serious air pollution a thing of the past.

28. Luft und Luftverunreinigungen (Air and air Pollution). Z Lebensmit Unt Forsch 139(3);1969;29-32 (Suppl).

German regulations to control air pollution are considered. A list of substances which may be freed into the air is given together with the maximum amount which may be present.

29. PACCAGNELLA (B) and others. Gas chromatographic detection of ambient pollution by chloro-containing organic insecticides in the province of Ferrara. Arcisped. S. Anna. Ferrara 19(4 1966;357-65. [Chem Abstr 66;1967;2105 Ab No. 21916f].

Residues of chloro-contg. org. insecticides present in the ambient were detd. in soil, water, and foods (fruit, vegetable, meat, milk etc.) Chromatographic analysis of insecticides was made in food samples of either animal or vegetable origin (beef fat, milk, water, fruits, salad, tomatoes, carrots, artichokes, cauliflower, squash, hay, and soil)from the Ferrara markets. A Fractovap Model B ...

was used with an electron capture detector. The conditions were: glass column (200 cm X 63 mm) filled with 1% SE-30 GCP silica gas flow 45 ml/min; temp in column 175°, 200° at column exict and, 175° at detector; excitation potential 40 v.; background current 8 x 10^{-9} A. The results showed the presence of numerous insecticides in all the analyzed foods. The exceptions were thiodan, endrin, and methoxychlor which did not appear in any of the detns. Carrots were the only food to reveal a min. quantity of insecticide (0.01 ppm DDT), Relatively high concn. was found in artichokes (9.81 ppm lindane), soil (4.04 ppm DDT), animal fat (2.14 ppm DDE), tomatoes (2.22 ppm heptachlor), cauliflower (3 ppm Lindane), apples (6.4 ppm DDT), and in cow milk (10.6 ppb. dieldrin and 5.25 ppb DDE). In drinking water from the public water work of Ferrara max. concn of DDT 1.58, DDE 0.36 and lindane 0.10 ppb was found. In well water from the rural section of S. Martino (cultivated with fruit trees) DDT 3.45, DDE 0.48 and lindane 0.40 ppb. was found. Water from the Po river contained only traces of lindane, heptachlor, and DDT.

30. PARKER (A). Air pollution from road vehicles. Proc Ann Nat Soc Clean Air No.34;11-50(Eng) 1967. [Chem Abstr 70;1969;234 Ab No.80638x].

The results of a study on air pollution from road vehicles are discussed including: the nature and extent of the problem; pollution from gasoline driven vehicles and from diesel motor vehicles and technical aspects of control; legislative and administrative aspects of control; road vehicle pollution and town planning; and research on motor vehicle exhaust gases in West Germany.

31. ZORIN (VM). Atmospheric pollution by discharges of an oil plant. Gigiena i Sanitariya 31(11);1966;98-99 [Chemical Abstr 66; 1967;3062 Ab No. 31833r].

The concentration of CH_2:CHCHO in the neighbourhood of a drying oil plant was reduced greatly by the use of an improved tower waterspray purifier and reduction of the operating temperature from 230 to 150°.

PESTICIDES INFLUENCING AIR POLLUTION

32. ABBOTT (DC) and others. Air pollution, pesticides, organochlorine compounds. Organochlorine pesticides in the atmosphere. Nature 211;1966;259-61.

The methods of sampling air in rural and metropolitan (Lond) areas, and of measuring the organochlorine pesticides contained in it are described. The measurements indicate the general occurrence in the atmosphere of minute traces of some of the persistent organochlorine pesticides (α and γ BHC, dieldrin, DDE, DDT, TDE). Further studies, may indicate whether the pesticides derive from within the shores of the

33. BATIIGELLI (Mc). Sulfur dioxide and acute effects of air pollution. J Occup. Med 10(9);1968;500-15 (Eng) [Chemic Abstr 70;1969;Ab No. 40460b].

A review is given of the conflicting evidence implicating SO_2 in acute air pollution episodes. On balance, the he effects of urban pollution do not appear to involve SO_2 i their mechanism.

34. DRUETT (H) and MAY (K). Open air factor (Microbiological rese establishment, Porton down). New Scientist 41;1969;579-81

Spider webs have played an unusual role in the discovery by a team at the Microbiological Research Establishment, Porton of a mysterious component of open air which has potent germ killing ability. Possibly the result of a chemical research between clean air and car exhaust fumes Open Air Factor may be causing insidious and so-far unnoticed damage to crops.

35. LLOYD (GA) and BELL (GJ). Mobile laboratory methods for determination of pesticides in air. Part 1. Phosphorothiolothionat Analyst 91;1966;806-8.

To study exposure of human beings to highly toxic insecticides, it is necessary to measure them in air with an accuracy greater than 0.1 μg per m^3 of air. The new method described shows how phosphorothiolates can be readily hydrolysed to yield thiols which can be determined by a suitably modified colorimetric procedure of extremely high sensitivity. Several insecticides were successfully estimated by this method, but several others e.g. phosphorothionates and some phosphorothiolothionates, could not be estimated.

35a. LLOYD (GA) and BELL (GJ). Mobile laboratory methods for the determination of pesticides in air. Part II. Thionazin. Analyst, 91;1966;808-9.

A colorimetric method is described which can be used in the field for measuring thionazin in air at concentrations of about 0.1 mg per cubic metre. Thionazin is first hydrolyzed to hydroxypyrazine, which is then reacted with bromine to form a glutaconic aldehyde. Condensation of the latter with p-phenylenediamine hydrochloride yields a reddish brown polymethine dye that is soluble in acetone.

Formaldehyde, and alkyl or aryl organomercury fungicide which may be used with thionazin cause negligible interferen when present in amounts up to 100 μg.

36. LLOYD (GA) and BELL (GJ). Mobile laboratory methods for the determination of pesticides in air. Part III. Analyst 92;1967;578-80.

The collection of airborne droplets or vapour of movinphos and the mobile laboratory method for its determination are described.

Movinphos is first hydrolysed in cold aqueous alkali-isopropyl alcohol to form principally the keto-isomer of methyl acetoacetate which slowly enolises in the solvent mixture. Addition of bromine to the double bond of the enol yields a bromo-ketone that reacts readily with cyanide ions to liberate cyanogen bromide. The latter is determined colorimetrically by Aldridge's procedure, substituting p-phenylenediamine for benzidine in the chromogenic reagent.

The method is sensitive to about 5 μg of movinphos and can be used to detect concentrations of about 0.1 mg per m^3 of air.

AIR POLLUTION INFLUENCING FOOD

37. DONOVAN (PP) and others. Lead contamination in mining areas in Western Ireland. Part 2. Survey of animals, pastures, foods and waters. J Sc Food Agri 20;1969;43-5.

Incidence of lead contamination was investigated in the following ways; (i) lead values in viscera, blood and faeces of dead animals and control of lead contamination in blood, faeces and milk of live animals in mining areas; (ii) examination of pastures in areas adjoining mining operations and road dust; (iii) analysis of foods, milks and waters in the mine vicinity; and (iv) lead content in workers blood due to exposure in mines.

Investigations under (i), (ii) and (iii) are dealt with in this paper. As a result of the toxicity results found in the laboratory the mining authorities instituted precautionary steps in the mining operations to eliminate lead 'fallout'.

38. THOMPSON (CR). Effects of photochemical air pollutants on zinfandel grapes. Hort Sc 4(3);1969;222-4 [Chemical Abstr 72;1970;101 Ab No.39852r].

For an investigation of the effects of photochem. smog on the Zinfandel grape, 12 plts were started on May 2, 1968 in Cucamonga vineyard under plastic cover, by using vines carrying approx 2 leaves by ambient air while the remaining plts received an equiv. amt. of air filtered through activated C. After 14 weeks the following results were obtained: Leaves growing in filtered air were conspicuously less stippled than the controls, and mature filtered air leaves weighed 13% (av. dry wt.) more than controls, at the same time showing a higher chlorophyll content (ratio of 4[illegible] to 28.8 for the controls).

higher total wt. per vine for the filtered-air plants, but results were not considered relevant because of considerab variation. Two sets of 4-100 berry lots each from the 2 types showed an av. wt. advantage of 26.7% in favor of the filtered air grapes. Anal. of the juice indicated 20% more sugar in the filtered air grapes. After pruning in Jan. 1969, dry cane wt. of the filtered air vines was 30% higher than that of the ambient-air ones. Photochem. oxidents reduce harvest yields, primarily by apparent substantial destruction of chlorophyll. Since grapes store considerable amts. of carbohydrates in the roots, results of a planned 2nd-year study are expected to accentuate these differences.

39. KURTZ (FE) and others. Effects of pollution of air with ozone o flavour of spray dried milks. J Dairy Sc 52(2);1969;158-6 (Eng) [Chemical Abstracts 70;1969;233 Ab No. 66891t].

In an investigation of seasonal variations in the flavour quality of milk powders manufd. in the dairy products lab., a series of expts. was conducted in which low heat, spray dried milks were manufd. during a period of low background levels of O_3. The effect of O_3 on the flavor of dried milks was ascertained by manufg., in each expt., powders both with and without addn. of O_3 to the drier air, and subsequently evaluating their flavor by a trained taste panel. Levels of reported by others as occurring in the atm. of the Washingto area during the warm weather months were sufficient to substantially lower the flavor score of dried milks. Skim m powders manufd. in air contg. 32 ppb. O_3 averaged 1.7 flavor points (on a 10-point scale) lower than those manufd. under background level of 2 ppb. Under the same conditions, whole milk powders averaged 2.9 points lower than the control powders. Foaming heightened the damaging effect of O_3 on flavo quality. Raising the O_3 level from 32 to 52 ppb. produced little or no further effect on the flavor of whole milk powder and only a questionable effect on the flavor of skim milk powder.

40. ZACHAR (L). Alkaline pickling of aluminium. Magy. Alum. 6(6);1969;179-82 [Chemical Abstracts 71;1969;218 Ab No.94095

A very detailed description is presented describing practica experiences in pickling. Chem. reaction and equations are given. Difficulties in air pollution and of the pollution of the chemicals are laid out. Explosion avoidance is emphasized and devices are also detailed. The importance of protective clothing and labour protection is emphasized.

AIR POLLUTION INFLUENCING AGRICULTURE

41. MIDDLETON (JT). Effects of air pollution on agricultural crops. Annu Dry Bean Conf. 6th, Los Angeles 1963, 45-9. [Chemical Abstracts 66;1967;11023 Ab No. 112560y]

The effects of ethylene, SO_2, O_3, oxidant, and fluoride on agriculture in damaging leaves and flowers, and on crop yield and livestock, and the role of air sheds in plant injury are reviewed. Speedy local control of stationary sources, state control of mobile sources, and plans to develop more hydroelec. power and motor vehicles not powered by org. fuels are recommended. Thresholds for crop damage for each of the 5 agents are given for representative crops.

TREATMENT OF AIR POLLUTION

42. CROSS (FL) and ROSS (RW). Single-pass dryer reduces air and water pollution. Food Engin 41(12);1969;83-85.

At Tropicana products, Bradenton, Florida, waste from processed citrus fruits is converted into cattle feed selling at $ 18/ton or more. The peel is dried in hot furnace gases which are then recirculated through the drying drum, then passed to an evaporator in which they dry the liquor. The concentrated molasses from the evaporator goes to the peel drier. The amount of fines in the gas vented to the atmosphere is low because peel is not put directly into the furnace flame, and the exhaust gas from the drier is scrubbed in the evaporator.

43. SRI RAMULU (T). Environmental degradation and pollution need for the establishment of an air pollution monitoring programme in India. Science and Culture 37(2);1971;80..

Methods for the collection of data for assessing pollution effects are described. It is hoped that with a well planned national programme if such a beginning is made now, by the time the goals of industrial and urban developments envisaged in the present 5 years plans in the country are achieved, formation of suitable legislation for effective air pollution control would be easy.

WATER POLLUTION

44. MATZ (A). Water pollution. Potato Chipper 23(12);1969;42, 46.

The danger of polluted water, particularly that containing sewage, is emphasised as it can be responsible for death in human beings. Above a certain limit the cleansing organisms in streams are killed by the pollution and further build up occurs. Hazards of DDT are serious as this chemical is not decomposed and may be present in food consumed.

45. NEWMAN (F). Water pollution study. Chemistry 42(1);1969;28-9 (Eng). [Chemical Abstracts 70;1969;208 Ab No. 70919q].

A water pollution study is reported of the water quality on a local stream, the North Branch of Rancocas Creek nea Burlington, N.J., The elec. cond. and pH values and the concn. of dissolved and in alkylbenzenesulfonates were detd. for water samples collected at 5 sites. The dissol 0 concn. was measured by oxidizing $Mn(OH)_2$ with dissolved 0 in the sample to give $MnO(OH)_2$ which in the presence of H_2SO_4 dissolves and liberates free I from previously added KI in an amt. exactly equiv. to the original amt. of dissolved 0. The free I is then measured by titrn.with $Na_2S_2O_3$ using starch as indicator. The concen. of alkylbenzenesulfonates, C_{12-13} branched chain compds. commonly used in detergents, was detd. directly by reaction with methylene blue dye to give a blue colored salt. The salt is extd. into $CHCl_3$ and the concn. is detd. colorimetrical

46. SÄRKKÄ (M) and others. Water pollution by Finnish dairies. Intern Dairy Congress 1E;1970;11.

Average composition is given of waste waters from 52 dairi (classified into 3 types) and discussed in relation to the water law passed in Finland in 1962.

47. JOHNSON (NH). Water pollution research laboratory. Machinery Lloyd No.23;1964;34-37.

48. Large increase in number of sponsored projects of WPRL: Water pollution research laboratory and warren spring laboratory open days this week. Surveyor 130;1967;17-19.

49. Canada's campaign to fight water pollution. Canadian Fisherman 56(3);1969;17-18.

Work being carried out on the water in the Great Lakes of Canada in connection with the Prevention of pollution is outlined briefly.

50. BURKE (GW). Transportation accidents and water pollution. Purdue Univ., Engl Bull., Ext. Ser. No.117(Part I);1964; 358-68 [Chem Abstr 66;1967;565 Ab No.5563v].

An outline of the transportation industry's water pollution problem is presented. Pollution resulting from various modes of transportation (rail, barge, pipeline etc.) is discussed.

51. GUDBOLE (SM) and others. A method for the examination of large volumes of water samples for suspended cell culture. Environ Health 8(1);1966;70-72.

A method for the examination of large volume of drinking water for the detection of virus pollution has been described. Trypsinized monkey kidney cells are suspended in the sample water to which concentrated M + Hanks medium is added, and are incubated for seven days at 36°C. The virus particles that might be present in sample water are thereby given an opportunity to grow at the cost of suspended living cells for subsequent detection by conventional virology methods. The method totally eliminates the need for the concentration of the sample water. The method has so far detected as little as 12.5 $TCID_{50}$ enterovirus units per 100 ml of artificially polluted drinking water. The work is in progress.

52. Symposium on water supply and water disposal. Food Tech 25(2); 1971;12?.

Methods of reducing pollution loads and water utilisation rates before waste products are discharged from canneries, dairies, and other food processing plants was the subject of a symposium held during the Third International Congress of Food Science and Technology in Washington, D.C.

WATER POLLUTION INFLUENCING AGRICULTURE

53. YAKUBOVA (RA) and BASHIROV (RR). Chemical application to agriculture and the problem of water purity in irrigated regions. Gig. Sanit. 31(9);1966;21-3. [Chemical Abstracts 66;1967;1365 Ab No. 13964e].

The following concentrations of insecticides in mg./l. were observed for both surface and underground water sources in various portions of the Uzb. SSR:DDT traces to 0.97, hexachlorocyclohexane 0.03-2.52, aldrin 0.006-0.54, methylmercaptophos 0.015-0.2.

54. [illegible] (CH). Reflection on water pollution problems. Sugar esters. Symp. (Pub. 1968) 1967;121-8 (Eng) [Chem Abstr 70;1969;206 Ab No. 70917y].

The origins of surface and underground water pollution are discussed with special emphasis on detergent pollution. The use of sucrose ester surfactants in place of branched-chain alkylbenzenesulfonates was considered.

55. GEORGE (MG). Further studies on the Nematode infestation of surface water supplies. Environ Health 8(2);1966;93-102.

Results on the species composition of nematodes in final water, their qualitative and quantitative variation [in] differe seasons and the possible build up of worms on the filters during runs are given. A few observations to check whether the nematodes grow in the underdrains were made from a new water works.

A maximum number of 665 worms per 4.5 litres was recorded during the rainy season in final water. Significance is attached to the appearance of such large numbers of worms in rainy season as the coliform counts are high in raw water during this period.

56. HOWE (LH) and PETTY (CF). Thin layer chromatographic quantitati of abate (O,O,O',O'-tetramethyl-O,O'-thiodi-p-phenylene phosph rothioate) residues in water. J Agri Food Chem 17;1969;401-

Abate was added in various concentration (33-107 μg/1) to distilled water, surface water and a 4:1 mixture of surfac water and settled sewage. A t.l.c. method for examining the $CHCl_3$ extract of the aq. mixtures for the presence of Abate, showed average recoveries of 75% (coeff. of variation 6%) for all three mixtures.

57. LUCZAK (T) and SITKIEWICZ (D). Effects of tritox, DDT, DMDT, and γ-hexachlorocyclohexane on physical and chemical properties and bacteriological indices of water pollution. Rocz. Punstw. Zakl Hig 20(4);1969;495-501 (Pol) [Chemical Abstract 72;1970;290 Ab No. 70427c].

Effects of (1) powd. Tritox contg. 1% tech. DDT, 2% DMDT 0-5% γ-HCH, and a mineral carrier, and of (2) liq. Tritox contg. 10% tech. DDT, 15% DMDT, and 5% γ-HCH on distd. water tap water, and river water were detd. Odor was detected at level of 0.2 (1) and 0.03-0.06 (2), and 0.4 (1) and 0.06-0.075 mg/1. (2) in distd. and tap water, resp. taste was discerned at 0.2-0.6 (1) and 0.015-0.030 (2), and 0.3-0. (1) and 0.06 mg/1. (2) in distd. and tap water. resp. (2) at levels of greater than 3.82 mg/1. decreased BOD and at levels of 8.59 mg/1. or higher decreased sol. O lesser than 4 mg/1. (1) had no effect on water microorganisms, (2) greater than 19.2 mg/1. increased bacterial count.

58. REIGNER (I) and others. Will the use of 2,4,5-T to control strea side vegetation contaminate water supples? J Forst 66(12);19 914-8 (Eng) [Chem Abstr 79;1969;243 Ab No. 67011t].

Either the butoxyethanol ester in a H_2O-plus-pil (8.5:1) carrier (A) or an emulsificable acid formulation (Am Chem No. ACP M 654) in a H_2O carrier (B), of 2,4,5-trichlorophenoxyacetic acid was sprayed upon the vegetation along both sides of streams for a distance of 305 m to a depth of 6 m. at the rate of 22 ig/ha. Downstream water

59. SAWYER (R) and others. Separation, identification and determination of fluoroacetamide residues in water, biological materials and soils. Part . Identification and determination by gas liquid chromatography. J Sc Food Agri 18;1967;287-9.

The methods described, for clean-up and concentration of fluoroacetic acid extracted from water and urine, gave recoveries of about 70 ± 5% of added amounts (0.01 -0.5 and 0.05-1 ppm, respectively).

60. SAWYER (R) and others. Separation, identification and determination of fluoroacetomide residues in water, biological materials and soils. Part I. Analytical technique. J Sc Food Agri 18;1967;283-6.

An improved analytical technique for fluoroacetamide residues below 0.2 ppm in water is described, together from soils and to be estimated by the same procedure.

61. SESHAPATHI RAO (D) and SATYAVATHI (D). Indigenous vegetable protein hydrolysates in bacteriological examination of water. Environmental Health 8;1966;142-46.

Studies have been conducted to find out the suitability of various protein hydrolysates prepared from several indigenous sources for bacteriological examination of water. Their nutritive values were studied and compared with the standard broths using pure cultures of E.coli, V.cholerae and S. faecalis. The results obtained showed that they are quite efficient in replacing the imported peptones for preparation of bacteriological media.

62. SMITH (JW). Identification and evaluation of toxic effects of organic micropollution to (in water supplies). Diss Abstr B1969;29(8);2921 [Chemical Abstr 71;1969;241 Ab.No.15911n].

BIOLOGICAL EFFECTS OF WATER POLLUTION

63. McKINNEY (RE) and PFEFFER (JT). Effect of biological waste treatment on water quality. Amer J Public Health 55(5);1965;772-782.

64. WILBER (CG). Biological aspects of water pollution. New Scientist 44(670);1969;567-8 [Commer Fish Abstr 23;1970;21(9.19)].

This book, based mainly on work done in North America, is a useful, technical account of all the major pollutants and of the ecological effects of water pollution. The author states that it was written for administrators, among others. The reviewer states that its value to scientists should be considerable.

65. WILBER (CG). The biological aspects of water pollution 1969.

66. EDWARDS (RW) and BROWN (VM). Pollution and fisheries: A progress report. Water Pollution Control 66;1967;63-78.

67. KARIYA (T) and ETO (S). Studies on the postmortem identificati of the pollutant in fish killed by water pollution. XI. On acute poisoning with tin plating solutions. Bull Jap Soc Fish 35(12);1969;1172-78 [Commer Fish Abstr 23(6);1970;26 (9.19)].

Two kinds of solution are commonly used in tin plating: alkaline and acid. The authors determined the survival ti of goldfish (Carassius auratus) exposed to both kinds of plating solution and examined their bodies to determine the distribution of Sn therein. The 48 hr. medium tolerance limit for both plating solutions was about 100 ppm. The bodies of fish killed by these solutions contained more than 13.0 γ/g Sn washing them in running tap water for, 24 hr. after death did not purge them completely. Fish killed by tin plating solutions showed concentrations of Sn in all parts of the body; fish killed and then soaked for 15 to 24 hrs in the solutions showed Sn concentrations in the skin, gill, and muscle only (none appeared in the spleen, hepatopancreas, kidney, or digestive organs). The Sn content of fish killed by solutions containing organic tin compounds was much lower than that of fish killed by tin plating solutions.

68. KARIYA (T) and others. Studies on the postmortem identification of the pollutant in fish killed by water pollution. X. Acute poisoning with lead. Bull Jap Soc Sc Fish 35(12);1969;1167-71.

69. KARIYA (T) and others. Postmortem identification of the pollutant in fish killed by water pollution. VII. Detection of nickel in the fish. Nippon suisan Gakkaish 34(5);1968;385-9 (Chem Abstr 72;1970;214 Ab No. 6083n).

In this study, an attempt was made to detect Ni in the bodie of fish killed by Ni solutions. Ni content was detected by the dimethylglyoxime method. Ni was clearly detected in the bodies of fish killed by $NiSO_4$ solution and by 3 kinds of Ni-plating solutions, moreover it was detected in the bodies of living fish in Ni solutions in these experiments. It was also possible to detect after washing with the running tap water for 24 hours after death. Ni in normal fish was not detected with accuracy of this method. According to these experiments, it was concluded that this method could be used for the postmortem identification of the pollutant in the fish killed by Ni solutions.

70. OGASAWARA (J). Postmortem identification of the pollutant in fish killed by water pollution. VIII. Acute poisoning with phenol Nippon Suisan Gakkaishi 34(9) 1968;764-9[Chemical Abstr 72;1970;228 Ab No. 53327e].

An attempt was made to determine the phenol content in fish killed by phenol solution. Phenol was not present in normal fish. However, rainbow trout, carp, and ayu fish were killed by phenol at 4, 50, and 9 ppm in 3 days respectively. Phenol was detected in fish killed by phenol solution even after washing with running water for 24 hours phenol was detected in the skin, muscle, gill, digestive organs, liver, spleen, and kidney, whereas it was not detected in the digestive organs, liver, spleen and kidney of the fish kept in the phenol solution after death by suffocation. This method could be used for postmortem identification of the pollutant in fish killed by water pollution.

71. WILLIAMS (AK) and SOVA (CR). Acetylcholinesterase levels in brains of fish from polluted waters. Bull Environ Contam Toxicol 1(5);1966;198-204.

DRINKING WATER POLLUTION

7.. MacLEAN (RD). Epilogue on Zermatt. Instn. of water Engineers. J 20;1966;532-7.

GROUND WATER POLLUTION

7.. VENKATARAMA CHARI (K) and others. Fluctuations in the fluoride content of ground waters in certain fluorosis endemic villages of Ongole district, Andhra Pradesh. Indian J Nutr Dietet 8(1);1971;5.

Studies on the fluctuations of the fluoride concentration of ground waters from 66 wells spread over 20 revenue villages in the taluks of Darsi, Kanigiri and Podili of Ongole districts (formerly Nellore District) of Andhra Pradesh have indicated that the fluctuations in the fluoride concentration in 35 per cent of the well waters are in such a manner that at times they carry less fluoride than the optimum recommended for the avoidance of skeletal fluorosis and at other times more fluoride than the optimum.

The present work indicates that the fluoride concentration of certain well waters in the endemic fluorosis villages of Ongole District show wide fluctuation with time. While drawing up plans for the supply of potable waters of low fluoride concentration, it is essential to avoid wells whose waters show appreciable fluctuation in their fluoride content. Scientists who attempt to bring a correlation between the incidence and severity of skeletal fluorosis with the fluoride concentration of the water supply should take into account the possible change in the fluoride content of the water with time.

74. EDMONDSON (WT). Phosphorus, nitrogen, and algae in lake Washington after diversion of sewage. Science 167(3946);1 690-1 [Commer Fish Abstr 23(12);1970;32(9.19)].

This paper describes some of the changes in chemical conditions and algae in lake Washington following diversion sewage effluent. Winter concentrations of phosphate and nitrate decreased at different rates: from 1963 to 1969, phosphate decreased to 28% of the 1963 concentration and nitrate decreased only to 80% of the 1963 level. During the period, free carbon dioxide and alkalinity remained relatively high. The amount of phytoplanktonic chlorophyl in the summer related very closely to the mean winter concentration of phosphate, but did not relate to t concentration of nitrate or carbon dioxide.

75. LESHNIOWSKY (WO) and others. Aldrin: Removal from lake water b flocculent bacteria. Science 169(3949);1970;993-5 [Commer Fish Abstr 23(12);1970;31(9.19)].

Of 33 aerobic bacteria isolated from lake Erie, 19 formed flocs in at least one medium and 10 formed flocs in 2 or more media. The ability of two of these latter to concentrate and accumulate aldrin (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-endo-exo-1,4:5,8-dimethanonaphthalene) from solution was studied. Both took up the pesticide rap during the first 20 minutes. The amount of aldrin adsorbe by an equal weight of cell flocs of one, an orange-red pigmented gram-negative rod tentatively identified as either a Flavobacterium or Protaminobacter, remained the same or increased only slightly with time beyond 20 min.; it eithe decreased or remained unchanged in the supernatant. Adsorption by the other bacterium, a gram positive species of Bacillus, was more rapid, maximum adsorption required to obtain the first adsorption value being from 12 to 15 min. all the aldrin added to the test solution was recovered fr this floc none was recovered from the supernatant. The concentrating effect of both bacteria was appreciable. Whe 0.041 g. of gram positive floc adsorbed aldrin from 25 g o water the concentration factor was about 625:1 within 20 m the capability of the gram negative floc was only slightly less.

76. NEWLAND (LW) and others. Degradation of γ-BHC in simulated lake impoundments as affected by aeration. J Wat Pollut Control Fed., 41;1969;R174-R188.

In the aerobic simulated lake impoundment, degradation of 15% of the added γ-BHC (benzene hexachloride) occurred in 2100 h and the isomer α-BHC was formed as the degradation product. In the anaerobic impoundment degradation was far more rapid and in the same incubation period, 90% of the added γ-BHC was degraded to α- and δ-BHC. Since aeration has a marked influence on the rate of reaction, it is presumed that γ-BHC is isomerised to the α- and δ-forms by a biological mechanism. (28 references).

77. KONRAD (JG) and others. Extraction of organochlorine and organophosphate insecticides from lake waters. Analyst, Lond. 94;1969;[illegible]0-2.

The benzene extraction method described previously (ibid., 1968; 93; 363) has been modified by increasing the water extractant ratioand introducing a concentration stage. These improvements ensure a 20-200 fold in sensitivity without much loss in accuracy or repeatability. Average recoveries of γ-BHC, aldrin, heptachlor epoxide, dieldrin, endrien p,p-TDE, p,p-DDT, p,p-methoxychlor, phorate, parathion-methyl, diazinon, parathion and malathion (each in concentration from 0.062 to 1.18 μg/1) ranged from 94 to [illegible] according to detector response. Recovery of heptachlor was 39 % mainly through loss by degradation or volatilisation.

78. WEIDNER (RB) and others. Rural runoff as a factor in stream pollution. J Wat Pollut Control Fed 41;1969;377-384.

Soil loss due to runoff is greatest when the crop is maize, somewhat less when it is wheat and least when it is meadow. Improved methods of cultivation, e.g. contour tillage, reduce the loss. Good correlations were found between silt losses and total solids and between total solids and BOD, COD total acid hydrolysable phosphate and total N. Despite an increase in the amount of fertilisers and manure applied under improved practices, the amount of pollutional load was less than that from watersheds using prevailing practice.

RIVER WATER POLLUTION

79. DAVID (A) and RAY (P). Studies on the pollution of the river daha (N. Bihar) by sugar distillery wastes. Environ Health 3(1);1966;6-35.

The hazardous effects of sugar and distillery wastes on the biological life, in particular the phyto and zoo-plankton and fish life, in river Daha (N. Bihar) have been studied.

80. Residues of organochlorine pesticides in surface waters. Water Pollution Control 66(6);1967;633-7.

81. ASKEW (J) and others. General method for the determination of organophosphorus pesticide residues in river waters and effluents by gas thin layer and gel chromatography. Analyst 94;1969;275-83.

A general, comprehensive scheme for the extraction of organophosphorus pesticides from river waters and sewage effluents is described. The pesticides, after extraction with chloroform, are determined by gas and thin layer chromatography. The procedure includes details of an improvement that enables all of the pesticides to be detected on thin layer chromatoplates with a phosphorus-specific ammonium molybdate spray. The use of gel chromatography on columns of Sephadex LH 20

82. HOLDEN (AV) and MARSDEN (K). Examination of surface waters and sewage effluents for organochlorine pesticides. Inst of Sewage Purification J & Proc Part 3;196 ;295-9.

83. TOMCZYNSKA (J). Effect of surface active substances and trace organic pollutants occurring in river waters on the growth of yeast. Prace Inst Lab Badaw Przen Spozyw 19(1);1969;43- (Pol) [Chem Abstr 71;1969;234 Ab No. 89988q].

The use of river water polluted with pesticides, fungicides, and surface-active agents for the manufacture of yeasts was discussed. Adsorption filtration using activated C such as Carbopol M (fine) and (or) Carbopol Z4CWZ-639 (granulated) was investigated. The concentration of the org. pollutants in $CHCl_3$ following extn. from water was 1.5-6.4 mg/l, where the concentration following extn. with alc. remained in the range of 1.4-5.7 mg/l $CHCl_3$ exts. were more toxic and affected the yeast growth to a greater extent than alc. ext Since such surface-active agents already impaired yeast grow when present at concentrations, exceeding as little as 10 m their concentration in water must be kept below that value a all times for practical purposes.

84. VENKATESWARULU (V). Ecological study of the algae of the river Moosi, Hyderabad (India) with special reference to water pollution. III. Algal periodicity. Hydrobiologia 34(3-4); 1969;533-69(Eng) [Chem Abstr 72;1970;88 Ab No.118532q].

The periodicity of algal populations at 4 different stations of the River Moosi was observed over a period of 2 years and the influence of the various phys. Chem. factors on different algal groups was studied. The algae as a whole reached their max. during winter (December-January) and touched min. during the rainy season (September-November). The rate of the water current was more or less inversely proportional to the total number of algae at all the station High water temps., seemed to accelerate the growth and multiplication of chlorococcales (Scenedesmus, Coelestrum, ankistrodesmus and Pediastrum) High concentration of nitrate and low dissolved O (at one station) appeared to be unfavourable for the development of this group. Desmids (Cosmarium Euastrum, Closterium, and Staurastrum), which were more in number only at 2 stations, were favored by high summer temperature and total solids. Diatoms, which formed the main bul of algal populations at all stations attained their maximum in winter and minimum during summer (May) and rainy season. These algae showed on inverse relation with temperature. The fluctuations in the silicates, nitrates, and phosphates seemed to show an inverse correlations with diatom periodici Diatoms were also favoured by higher concentrations of O in water. It is emphasized that higher concentrations of dissolved O in water lead to the formation of more nitrates, which in turn help in the production of large number of these alga Blue green algae (Chrococcus, Merismopedia, Aphanothece, and Oscillatoria) attained their maximum during the summer month and became rare in winter and rainy/matter and water temperature and an inverse relation with dissolved O. Euglenoid flagellates (Euglena, Phacus and Lepocinclis), like the blue-

/seasons. These showed a direct correlation with the oxidizable org.

green algae, were more in number during summer but with an optimum temperature of 28-31.5°. High summer temperatures seemed to be unfavorable for their development. pH of water showed an inverse relation in the periodicity of these algae whereas the total Fe content went almost hand inhand with these flagellates.

85. KOEMAN (IH) and others. Chlorinated biphenyls in fish, mussels, and birds from the river Rhine and the Netherlands Coastal area. Nature 221(5186);1969;1126-8(Eng) [Chem Abstr 71;1969;224 Ab No. 2499j].

Tissue exts. of fish, mussels, and birds in the Rhine river, the western Coastal area of the Netherlands, and the Wadden Sea were examined for their content of chlorinated compounds. Most of the compounds were polychlorinated biphenyls and their retention times increased with the number of Cl atoms/mol. Hexachlorobenzene was found in all 3 sampling areas, and 1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene was the only DDT deriv. detected. Telodrin was found only in seabirds and probably originated from a pesticide plant near the rivermouth. Tetrachlorobenzene and pentachlorobenzene were less persistent. Thus, polychlorinated biphenyls are a potential environmental hazard and a source of interference in insecticide detection. Although fatal concemtrationa have probably not yet developed along the Dutch coast, regular environmental monitoring is suggested.

BIOLOGICAL EFFECT OF RIVER WATER POLLUTION

86. PIPPY (JHC) and HARE (CM). Relationship of river pollution to bacterial infection in salmon (Salmo salar) and suckers (Catostomus commersoni) Transac Amer Fish Soc 98(4);1969; 685-90[Commer Fish 23(6);1970;24(9.19)].

Aeromonas liquefaciens is a ubiquitous water bacterium that causes disease and death in fishes whose resistance is low. In June 1967, when river temperature was 22.5°C, pollution control measures at a base metal mine on the Tomogonops, a tributary of the Northwest Miramichi River (New Brunswick), temporarily failed. About 39 hr. after the failure, the copper and zinc content of the water was measured at 1.1 toxic units (1.0 toxic units is just lethal to juvenile Atlantic salmon at summer temperature).

According to field records, the many suckers, shiners (Notropis cornutus , and salmon grilse that were found dead in the Northwest Miramichi between June and August had died of bacterial infection, the symptoms conforming to those caused by Aeromonas and Pseudomonas.

In June and July 1968, an epizootic among suckers developed in the Northwest Miramichi. River temperatures were high, water flow was unusually low, and a buildup of A. liquefaciens followed. Diseased salmon were found in the main Southwest Miramichi, suggesting to the authors that the disease originating in the northwest branch of the river had spread.

87\. LAHAV (M) and SARIG (S). Sensitivity of pond fish to cotnion (Azinphosmethyl) and parathion. Bamidgeh 21(3);1969;67-74. [Commer Fish 23(4);1970;29(9.19)].

In this report of research supported by a grant from the Israeli Field-Crop Grower's Association, the authors examir the fish-poisoning potential of pesticides applied to field crops adjoining fish ponds. To find a way to limit the damage caused by the pesticides, they determined the lethal dosages as well as the concentrations that would not cause damage to the fish affected--carp, mullet, and tilapia.

Parathion and cotnion as supplied by the Field-Crop Growers Association were dissolved in xylene at concentrations (w/v of active material) of 50 and 20 percent, respectively. Cotnion was found to be from five to ten times more poisonou to the fish than parathion is. In 96 hours, 0.2 ppm cotnior killed all the carp, 0.04 ppm killed all the tilapia, and 0.008 ppm killed all the mullet. Carp were killed by 0.12 ppm after 10 day's exposure but survived a concentration of 0.1 ppm. The highest nonlethal dosages for 96 hours' exposure were 0.1 ppm for carp, 0.008 for tilapia, and 0.004 for mullet.

The salinity of the water did not affect the mullet's sensitivity to cotnion. Continual periodic application of sublethal amounts (single exposure for 96 hours) down to 0.02 ppm killed the carp.

In 96 hours, 1 ppm parathion killed all the carp, 0.5 ppm killed all the tilapia, and 0.125 ppm killed all the mullet. The highest nonlethal dosage of parathion was 0.5 ppm for carp, 0.25 for tilapia, and 0.1 for mullet.

SEAWATER POLLUTION

88\. ESTES (JE) and GOLOMB (B). Oil spills: Method for measuring their extent on the sea surface. Science 169(3946 ;1970;676-678 [Commer Fish Abstr 23(12);1970;32(9.19)].

This article described a system for the repeatable, economical measurement of the areal extent of oil spills at acceptable levels of accuracy. The system involves overflights of the area with a thermal infrared imaging system, densitometric enhancement of the infrared images, and automatic digital planimetry of the areas of specified image densities.

89\. HORN (MH) and others. Petroleum lumps on the surface of the sea. Science 168(3928);1970;245-6 [Commer Fish Abstr 23(8);1970; 26(9.19)].

At least 75 per cent of the 734 neuston tows made during cruise 49 of the R.V. Atlantis II (from Rhodes to São Miguel) between 10 May and 28 June 1969 contained tarry lumps ranging in size from 1 or 2 mm. to about 10 cm. Analysis revealed that the tar was soluble in chloroform and chromatographically like crude oil. Since the low-boiling fraction of the oil--that is: the fraction that cont

diately toxic substances--was retained in the lumps, the authors concluded that the formation of lumps tends to conserve the petroleum's poisons.

Several marine organisms were associated with the lumps, Idotea metallica, a pelagic isopod ranging in length from 10 to 25 mm., clung to them. Lepas pectinata, a goose barnacle, was often attached; at one station, 150 barnacles ranging in length from 2 to 3 mm were attached to four lumps that displaced 40 ml. Since the growthrate of barnacles living on tar lumps is about 1 mm. a week, the authors inferred that the barancles were about 2 months old and that the lumps were at least as old. A grayish film, presumably composed mostly of bacteria, covered the lumps; it consumed oxygen at about 4 $mm^3/hr/cm^2$ of tar surface. Of 10 sauries (Scomberesox saurus) caught in the western Mediterranean and ranging in standard length from 164 to 255 mm, the stomachs of three contained large amounts of tar. Bigelow et al (1953) reported that all the larger predaceous fishes feed on saury; thus the ingestion of tar by these epipelagic fish introduces a toxic material directly into the marine food chain.

90. International concern about the baltic sea. New Scientist 46(697); 1970;105 [Commer Fish Abstr 23(11);1970;19(9.19)].

In February, the International Council for the Exploration of the Sea issued a report on pollution of the Baltic Sea. [Co-operative Research Report A15]. The report. complied by a working group of representatives from all the nations washed by the Baltic, deals with sewage, pesticide, mercury, oil, and thermal pollution. Its most notable observation is that the oxygen levels of the Baltic's deep waters have decreased to such extent, and the phosphate levels have increased so much, that the bottom, like the bottom of the Black Sea, will soon become lifeless.

The Baltic is separated from the North Sea by shallow, narrow sills that have a maximum depth of 18 m. The fresh water flowing into the Baltic greatly exceeds the evaporation, and the outflow of fresh water through the straits is about twice the inflow of saline water. (This condition is found in many silled fjords in Scandinavia, Canada, and other countires). The fresh water surface layer, which has a silanity of 6 or 7 parts per thousand, extends to a depth of from 50 to 70 m; there the salinity increases sharply to between 10 and 12 parts per thousand. This halocline impedes the turbulent interchange of surface and deep waters, resulting in a body of water in the deeper parts of the sea that is relatively isolated. Assembled reports from date recorded at Baltic marine stations since the turn of the century present a picture of the landsort deep, south of Stockholm, that looks like the figure on the right. The phosphate now present there is the result of complete deoxygenation and the growth of sulphate-reducing bacteria in the water. Added to this condition is a well established increased salinity in the deep water, which has forced the

stability so that oxygen exchange across this density dis-
/is continuity/restricted even further.

The decrease in oxygen content of the deep water may have a combination of sources: decreased oxygen supply in the inf ing waters; increased stability of the halocline; greater primary production in the surface layers (brought about by build up in pollution, which, in turn, increases the amount of oxidizable organic matter that falls into deeper water), along with an increased oxygen demand in the deeper layers; and direct supplies of organic matter to deep water from sewage and industrial waste. Data on this last source show that the amount of phosphorus added to Baltic by such pollutants as fertilizers and detergents is roughly equal t the amount discharged naturally by streams and water exchan The report points out that basic information about the phos phorus balance in the sea is urgently needed so that natural and artificial variations can be assessed separately.

91. IRUKAYAMA (K). Pollution of Minamata bay and Minamata disease. Advanc Water Pollut Res Proc Int Conf 3rd 3;1966;153-80 [Chem Abstr 72;1970;215 Ab No. 6088t].

First recognized in 1953, Minamata disease, a severe intoxication of the central nervous system had caused 41 deaths as well as numerous causes by Agt. 1965 in the Minamata Bay and Nigata areas. The poisoning was caused by the ingestion of fish and shell fish contg. MeHgCl which had slowly accumulat in the fish from minimal concentrations in the H_2O. The MeH a catalyst in the manufacture of AcH from CH:CH was discharg to the bay as a dil. solution Inorg. Hg compounds, although present in substantial amounts in the Minamata muds from industrial wastes, were not absorbed by the fish and not involved in the Minamata disease Clinical features included cerebeller ataxia, constriction of visual fields, and dysarthria. Pathol, findings involved regressive changes in the cerebellum, and the cerebral cortices. Concern was expressed regarding other organometal wastes such as $PbEt_4$ which did not respond to the treatment which was satisfactory for the inorg. pb wastes.

92. PEETERS (E). Installation of a device for studying marine pollution (Seawater sediments, marine organisms) in Belgium. Environ. Contamin Radioactive Mater Proc Seminar 196';503-19. [Chem Abstr 72;1970;541 Ab No.62059w].

An activation anal. device for the study of the contamination by trace elements in sea water, sediments, and marine organisms is discussed. Methods of sampling and processing and analyzing the samples are described. Radionuclides are not distributed uniformly in the suspensions or in the sediments. The initial results indicate the presence of ^{40}K of fission products, and of daughter products of the uranium family and of the actinium family.

93. SIROKAL (P) and others. Investigation of certain microconstituents in two tunicates. Limnol Oceanogr 14(2);1969;265-8(Eng) [Chem Abstr 71;1969;118 Ab No. 11025u].

Concentrations of 11 trace elements (Sc, La, Ce, Cr, Th, Rb, Cs, Sr, Fe, Zn, and Co) were detd. by activation anal. in 2 tunicates. Their concentration factors were calc. and are discussed in relation to radioecology and to seawater pollution with radionuclides. The treatment of samples and the radiochem. procedure are described.

94. OLSON (TA) and BURGESS (FJ)- Pollution and marine ecology. Interscience (NY) 1967;364. [Chem Abstr 70;1969;627 Ab No.6490b].

95. DYER (WJ) and others. In vivo assimilation by cod muscle and liver tissue of elemental phosphorus from polluted sea water. J Fish Res Board Can 27(6);1970;1131-39 [Commer Fish Abstr 23(12);1970;31(9.19)].

Recently Idler (1969) described an incidence of the pollution of sea water in a fishing area with elemental phosphorus resulting in the mortality of some fish. The present study was undertaken to determine the uptake by cod of elemental phosphorus from experimentally polluted sea water. The fish were exposed overnight (16 hr) to sea water containing 20-80 ppb (parts per billion) of elemental phosphorus; several fish were exposed only 30 min. Fifteen to thirty min. after the fish had been removed from the tank of sea water they were sampled for analysis.

The cod, held in sea water containing the elemental phosphorus, rapidly assimilated the phosphorus into their tissues. In the 16 hr. exposure of cod to 20-80 ppb of elemental phosphorus in sea water, phosphorus was concentrated about 1,000-fold in the liver, from 10- to 25-fold in the white muscle, and about 50- to 100-fold in the red muscle. The distribution of phosphorus in the various tissues appeared to be roughly proportional to the lipid content of the tissues. The absorbed phosphorus was quite uniformly distributed throughout the white muscle of fillet.

Because of the high concentration of the elemental phosphorus in the liver tissue, the authors suggest that analysis of the depot fat, sensitive indication of possible exposure of the fish to elemental phosphorus in the sea water environment.

96. LAMES (C) and KENWARD (M). Stirring up the oceans for profit. New Scientist 47(715);1970;378 [Commer Fish Abstr 23(12);197031(9.19)].

In August, deep ocean water began flowing through a mile-long 3.5-in. diameter pipelines into closed ponds built on the shore at St. Croix, Virgin Islands. The flow signaled completion of one part of the National Science Foundation's Sea Grant Program to increase the use of the Ocean's resources. It was the first step toward eventual use of deep

ocean water for mariculture, the generation of electric power, and the production of fresh water.

Theoretically the system will work essentially as follows, Ocean water, at a temperature of 5°C, will be pumped through condensers set in the path of highly humid trade winds. When the moisture-laden air is cooled, much of the humidity will condense and be recoverable as potable water. Meanwhile, the temperature difference between the deep water and the surface water (from 19° to 25°C) will be used to generate power. In a process already used by the French, a partial vacuum is used to generate low pressure steam. The steam is condensed in a chamber cooled by the deep water; a turbine placed between the evaporator and the condenser is turned by the steam. Finally the deep ocean water, with its dissolved phosphate and nitrate nutrients, will be piped into the ponds or lagoons that are to be used for mariculture.

Eventually, it is hoped, artificial upwelling may be created in tropical waters where the scarcity of nutrients from deeper levels millitates against a viable fishery.

ESTURINE WATER

97. HILL (WF) and others. Ultraviolet devitalization of eight selected enteric viruses in estuarine water. Appl Microbiol 19(5);1970;805-12 [Commer Fish Abstr 23(9);1970;33(9.19)].

Previous work has demonstrated that viruses continuously contaminate, via domestic pollution, this nation's waterways, including the saline waters of estuaries. Commercial artificial purification of shellfish will probably require large quantities of raw estuarine water. To insure public health safety, the raw sea water used for depurating shell fish must be treated to destroy pathogenic organisms. Ultraviolet (UV) radiation destroys coliform organisms and has been proposed as the treatment method in shell fish depuration systems. In earlier work (Hill, Hamblet, and Benton, 1969) at the author's laboratory, effective virological dis infection was achieved with poliovirus type 1 (vaccine strain) in continuously flowing sea water by the Kelly purdy UV Seawater Treatment Unit. Because of the potential hazard involved, the experiments were not performed with other members of the enteric virus group. The purpose of the present study was to compare the devital ization characteristics of six enteroviruses and one revirus with that of poliovirus type 1 (reference virus) suspended in estuarine water and exposed to UV radiation under identical conditions.

The tests were carried out in a special UV exposure chamber simulating the geometry of the Kelly-purdy UV Seawater Treatment Unit. The value of the surviving fractions of each virus was plotted against the UV exposure time. The standard regression analysis procedure was used for analytical treatment of the data.

Poliovirus types 2 and 3, echovirus types I and II, and Coxackievirus A-9 exhibited similar devitalization charac-

teristics (no statistically significant difference was found between their slope function and that of poliovirus type 1, P 0.05). Conversely, the devitalization characteristics of coxaackievirus B-1 and reovirus type 1 were dissimilar from those of poliovirus type 1 (a statistically significant difference was found between the slope functions, P 0.05). The difference (in devitalization of coxaackivirous B-1 and revirus type 1) was attributed to the frequency distribution of the aggregates, and the severity of the aggregation. The devitalization curve of coxsackievirus B-1 was characteristic of a retardant die-way curve: that of reovirus type 1 was characteristic of a multihittype curve. The calculated devitalization half life values were; poliovirus types 1,2 and 3---2.8, 3.1 and 2.7 sec; echovirus types 1 and 11 ---2.3 and 3.2 sec; Coxsackievirus types A-9 and B-1 .. 3.1 and 4.0 sec; and reovirus typel---4.0 sec.

The authors indicate that the experimental data presented can be extrapolated to the practical situation. They concluded that UV radiation can be effective and can be reliably used for treating estuarine water.

INDUSTRIAL AND CHEMICAL POLLUTION

98. EDEN (GK). Waste water problems. Nature 225(5234);1970;767-8 (Commer Fish Abstr 23(7);1970;25(?.19)].

The major questions about water pollution are not concerned with technical solutions (in most cases, these are available) but with how much the community is prepared to pay for a clean environment. Accordingly, the author of this book deals with the general nature of the problems, the technology of waste water treatment, legal and financial implications of the problems aspects of local planning, and problems peculiar to developing countries. The reviewer **criticizes** the lack of reference to work that is being done in the old world (he points out that the only reference to European experience is a brief descritpion of the Ruhrverbrand operation, the highly successful water supply and effluent disposal organisation in west Germany) and the limited applicability of the material contained (most of the technical matter is available in a number of specialized publications, he says, and those parts of the book dealing with administrative, legal, and financial matters refer almost exclusively to the situation in the United States). He concludes that the last chapter, which deals with problems in developing countries is sensible and is apparently based on the author's experience as a planning consultant.

99. FACCIANI (LJ). How to manage an industrial water pollution problem. Potato Chipper 28(12);1969;38, 40.

Methods which should be examined for eliminating waste which is present in water or treating this waste so that it is not present when the water is discharged into the stream are considered. It may be necessary to change the process producing the waste or even to relocate the plant. Waste removal from water must be taken into account when calculating total operating costs.

Tijdschr Chem Instrum

100. GOCKEL (H). Problems of waste water,/Chemical Abstr 70(14); 1969;60627q [Commer Fish Abstr 23;1970;24(9.1?)].

The different sources of waste waters are described. The release of waste water in the open sea is criticized and possible detoxication techniques for waste water are discussed, esp. those for inorg. effluents. Also the treatment of waste water from the galvanizing industry is described.

101. Government knows industry problems but still must act to stop pollution. N. MacVicar Food In Canada 28(2);1968;35,51,5

Some of the problems which must be overcome by those in t food processing industry to improve water pollution contr are mentioned. As many of the disposal problems are complex it should be possible to correct them in stages. Al methods proposed for water treatment must be approved by the authorities before putting into action.

102. JENKINS (SH). Industrial effluents. Lab Pract 20(1);1971;31.

Preliminary studies involving analytical and bacteriologi work are often required before remedial measures can be taken in cases of pollution by industrial wastes. The various techniques involved are described in this article

103. BOCCONI (G) and others. Phytotest for the study of industrial waste pollution. AnnIdrol 5(3);1967;81-9. [Chem Abstr 71;1969;286 Ab No. 73816w]

The phytotests, the tests on the relation between mineral waters and the growth or budding of vegetables are applie for studying the chem. defilement of superficial waters o effluents of some industrial factories near a small river of Pavia called Navigliaccio. Researches were made on t growth of small plants of wheat which indicate the defilement caused by a hosier's factory; the budding of the pea results slackened and fermentation occurs which provokes a nauseous odor which remains also when the water has been sterilized. The practical importance of such tests is emphasized in relation to the vegetable or animal life which can exist in such waters.

104. [illegible] and [illegible] (C[illegible]). Potential toxicity of kraft mill effluent after oceanic discharge. Progressive Fish Culturist 31(4);1969;207-212 [Commer Fish 23(1);1970;19(9.19)

This paper deals with the responses of an intertidal fish, the fluffy sculpin to kraft mill effluent and the potential toxicity of the foam that sometimes results when kraft mill wastes are discharged into the ocean. The toxic components of kraft wastes are extremely complex and highly variable. Consequently bioassays of the same concentrations of different KME samples may result in different median tolerance limits (TL), even with the same species of test organism. This variability is important not only in considering differences in mortality between tests but also in the possibility that low KME concentrations in tidepolls may result in toxic conditions, whereas high concentrations with different constituents may be harmless.

The fluffy sculpin has been studied to determine its tolerance for variations in temperature and salinity and to KME. This fish, a common tidepool inhabitant was selected because of its abundance and availability. It occurs from Southern California to Central British Columbia. It attains a length of 3.25 inches (Clemens and Wilby).

INDUSTRIAL POLLUTION BY METALS

105. I[illegible] (K). Accumulation of heavy metals in acquatic organisms; I. Copper content of oysters. Nippon Suisan Gakkaish 33(5); 1967;405-9. [Chem Abstr 71;1969;106 Ab No. 19833m].

The Cu contents in the meat of oysters (Ostrea gigas, O. circumpicta, and O. spinosa), collected from the part of Miyazaki Bay which was polluted by factory and mine wastes, were higher than those of the oysters harvested from the unpolluted part.

106. LAZAR[illegible]V ([illegible]). Content of poisonous chemicals, used in agriculture, in surface waters. Gidrokhim. Mater. 41;1966;180-91. [Chem Abstr 66;1967;4655, Ab No. 49109u].

The problem of surface and ground waters pollution by poisonous chemicals used in agriculture (insecticides, fungicides, herbicides, defoliants, and others) is discussed. Statistical data on the amt. of various chemical used in the past and planned to be used in the future, their content in waters, and methods of detn. of various poisonous chemicals in natural waters are the main topics discussed. [23 references].

107. NEMEROW (NL) and RAND (MC). Algal growth affected by degree and type of waste water treatment. Algae, Man environ Proc Int Symp (Pub 1968) 1967;391-402 (Eng). [Chem Abstr 70;1969;207 Ab No. 70908w].

Algal growth in streams and lakes may be linked to their increased contamination with nutrients from sewages. Expt were performed on the effect of soil percolation of sewag using different types of soil and sewage and measuring th compn. of the effluents and their influence on the growth algae. Studies of treatment plants on Lake Ontario indic that biol. treatment of sewage left the effluent more stimulatory for algal growth than did primary treatment.

108. GILDE (LC). Waste systems tailored to Campbell plants. Food Eng. 41(8);1969;80-3.

The removal of pollution from waste food processing water can be carried out by a number of methods. A new process is to allow the waste to flow down a gently sloping grass covered area in which the soil is an impervious clay. The soluble wastes are adsorbed on the organic litter and the water is in good condition when it reaches the bottom of the slope. In the early stages, before growth of the gras is complete, care must be taken to prevent erosion of the slope. Some other pollution control systems are described

109. Chemistry and toxicology of agricultural chemicals. A four-yea summary report 1965 through 1968. Food Tech 24(5);1970;4 [Commer Fish Abstr 23(8);1970;24(9.19)].

The report discusses in detail the history and past progre of the Food Protection and Toxicology center. The report discusses 57 research projects and is divided into four sections: (1) Analytical Methods and Instrumentation, (2) Biological Methods for Toxicity Measurement, (3) Biological Manifestation of Toxicity and (4) Environmental Fate of Pesticides and their effects.

110. GOFMEKLER (VA). Studying the embryotropication of chemicals. Gig. Sanit 34(8);1969;47-50[Chem Abstr 71;1969;234 Ab No. 116286t].

This paper describes the practices of the Inst. Obshech. Kommunal. Gig. im. Sysina including the method of administration of an atm. pollutant, the prepn. of the fetuses for microscopic sectioning, and the visualization of the skeleton.

BREWERY EFFLUENTS

111. UHL (A) and HANCKE (K). Degradability of brewery effluent by the trickle filter procedure. Brauwissenschaft 22;1969;90- and 208-13.

The trickle filter and its operations are described and it was shown that brewery effluent can be very effectively treated by this means. Fully purified and clarified effluent is better than domestic effluent and can even by diluted with untreated liquor. To achieve an outflow with a BOD of 25 mg/1,550 BOD)m^{3}h can be applied to the filter with a surface loading of 0.3 m^{3}n or 830 BOD/m^{3}h at a surface loading of 1.5 m^3/m^{2}h. With increasing loads, the total N in the clarified effluent increased. Under all conditions the phosphate level was >5 mg/1. A unit for chemically precipitating this phosphate was necessary to bring the level down to the required range (0.05-0.5 mg/1) [23 references].

112. KLOPPER (WJ). Effluent problem in the brewery. International Tijdschrift voor Brouwerij en Mouterij 29(3);1970;78-82.

The findings of the effluent Committee of the Kantoor Central Brewery are reported. By suitable means, which would also reduce beer and yeast losses, pollution can be limited to 540 grams BOD/hl beer.

113. AULT (RG). Brewery effluents. Chem Ind (Lond) No.4;1969;87-96. [Chem Abstr 70;1969;207, Ab No. 70907v].

A review is given of the following: the brewing process, the chem. compn. of brewery effluent, the principal sources of pollution in the brewery, the improvement in the quality of brewery effluent, the disposal of effluent, the treatment of brewery effluents on site, the factors affecting choice of treatment process, the activated sludge treatment with biol. filtration, the operational difficulties in the activated sludge process, the Flocor system, the Passveer process, and the treatment costs.

114. LINES (G). Liquid wastes from the fermentation industries. Water Pollut Contr 67(6);1968;655-68 (Eng) [Chem Abstr 70;1968;207 Ab No. 70905t].

Fermentation processes and methods of treatment and disposal of their waste waters, with reference to the distg. industry inthe U.K., are reviewed and their economic aspects discussed.

115. BOARD (RG). Biological aspects of organic waste treatment. Water Pollut Contr (Lond) 67(6);1968;614-21 (Eng). [Chem Abstr 70;1969;207 Ab No. 70904s].

The structure and function of the protocaryotic cell are discussed in a literature review of the mechanics and metabolism of current waste disposal processes.

116. BROWN (TJ). The impact of food wastes on the biological environment. Food Tech NZ 3(7);1968;25-27.

The changes which take place in natural water supplies when they become polluted with food wastes are mentioned. The stages in pollution as the waste moves downstream can be detected by examining the microorganisms present; recovery zones are determined similarly. Milk wastes can be used for spray irrigation of pastures as long as these are not over-sprayed.

117. PRASAD (RR) and DUTTA (BK). Pilot plant study on biological treatment of phenol bearing wastes. Technology 5(1);1968; 107 (Eng). [Chem Abstr 70;1969;237, Ab No. 40515y].

A unit was constructed with 3 connected 1-l. conical flasks. The liquor was fed into the 1st at a uniform rate, flowing from the bottom, then into the top of the 2nd flask, and similarly into the 3rd; then into a receiving bottle. Sludge entering the last was reintroduced into the first flask. Nutrients consisting of 0.1 g. each of KH_2-PO_4, $MgSO_4$, $(NH_4)_2SO_4$, with a trace of $FeSO_4$ and 0.05 g. NaCl in 100 ml. H_2) were added from a buret into the first flask. Air was passed through continuously, the rate being measured by a wet gas meter. The ranges used for flow of phenolic liquor varied from 0.28 to 0.51/hr 29-33^0 and 39-40^0, for temp. and an av. air flow of 3 m^3/min/m^3phenol concn was detd. by the modified permanganate value method. At 29-33^0, phenol was almost completely destroyed during a detection period of 8 hours. On the basis of these results, a pilot plant was constructured. The plant was started with bacterial cultures from stock; nutrient soln. was added to each compartment. Air flow was started and phenol was added at regular intervals. After 7 days, the activity of the culture had developed satisfactorily. With addn of phenol to a concn. of 300-400 mg/l, almost all of the phenol was destroyed in 6-7 hrs. by the mesophilic bacteria. With phenol added to a concn of 822 mg/l however, removal was only 60%, the buildup adversely affecting the culture. Since decompn proceeded satisfactorily at the lower concn., it was suggested that greater concns. be dild.. Following these studies, a large commercial plant was designed to treat phenolic liquors.

INDUSTRIAL WASTES INFLUENCING FOOD PRODUCTS

118. Anon. Eliminating polluting wastes at tomato processing plants Canning Trade 92(2?);1970;10.

Pollution during tomato processing can be reduced considerably by cleaning, pulping and making into juice in portable plants brought to the growing areas. The waste is spread on the farm land and wash water is also returned to the land as irrigation water. The work carried out on this production method showed that good quality juice could be produced in this way.

119. SMITH (K.?). Estimation of industrial pollution and costs of industrial waste treatment with reference to the meat packaging industry. Disseration Abstracts International Section B. The Sciences and Engineering 30(?);1970;4176.

Some interrelationships between the production process and water pollution in the meat packaging industry were studied in order to estimate industry wasteloads, wasteload reduction resulting from waste treatment and associated costs. A regression analysis equation predicting wasteload/unit of product on the basis of plant characteristics was developed from economics and sanitary engineering sources, information from 227 meat packing plants and data on waste water quality from 73 of these plants. Statistically significant plant characteristics wer wastewater/unit of product and product mix; factor mix and plant size were not significant. There was a pos-itive relationship between wastewater volume/unit of product and wasteload/unit of product. Estimates of various characteristics, production data and gross wasteloads were developed for 19?? and 1977, and reveal that allocation of capital reserves could be improved. Between 1966 and 1970 gross wasteloads are expected to increase less than production, but wasteload removed will double while the replacement value of waste treatment facilities will treble.

120. TOOKOS (I). Sewage investigations at poultry processing plants. Baromfiipar 16(11);1969;512-19.

Investigations at 6 poultry processing plants showed that 62-83% (average 71) of total impurities can be removed by a mechanical treatment (filtration, sedimentation) of sewage. Water consumption was 6.3-73.4 m^3/metric tonne of processed poultry (average 20). Specific data of sewage impurities were 27.5 kg COD.10.2 kg BOD. 27.8 kg total suspended matter/tonne of processed poultry. Data referring to the individual plants and to various steps in processing are tabulated. Highest impurity values (COD, ?4?0 mg/l) were found in the combined effluents from coop washing and turkey processing, and in the combined effluents from liver and egg processing (COD 3348 mg/l). Cooling water is generally not recovered.

121. GRIGG (RW) and KIWALA (RJ). Some ecological effects of discharged wastes on marine life. Calif Fish and Game 56(3);1970;145-155. [CommerFish Abstr 23(10);1970;27(9.19)].

The largest sewerage system in southern California in terms of discharge is the Los Angeles sewer outfall at White Point, Palos Verdes peninsula (near San Pedro, California) where approximately 360 million gallons are discharged daily. The depth of the outfall terminus and diffusers ranges between 165 and 195 ft. Treatment is primary.

In 1954, the Institute of Marine Resources (IMR) of the University of California contracted to study the effects of Oceanic disposal on the nearshore environment at White Point. This study included a survey of the effect of effluent on the biology of the area. The present paper described the results of a recent survey (June 1969) that partially duplicated this program. The purpose was to collect comparable data, and to examine these in order to detect possible long-term ecological changes.

Data collected during the 1969 survey show that the number of species enumerated at each station is negatively correlated with the amount of fine grain organic laden sediment present in the cores (Kendall Tau Correlation Coefficient, -0.30, p=0.10). Fish appear to be particularly affected. The reduction of benthic species is probably due to decrease settlement and survival of their larvae caused by fine grain sediments which cover the bottom. Since these benthic speci make up the diet of many resident fishes, they in turn would be expected to decline. In an 8-eight year study of southern California kelp bed resources, it was found that the diversity (number of species) of the fish was not altered significantly by the presence or absence of giant kelp but rather was positively correlated with the degree of bottom relief (North and Hubbs, 1968). Since the bottom topography at White Point was not changed, the decline of fishes there, if not caused directly by toxic waste products may indicate that relief is more important as a substrate for food rather than a source of shelter or a point of orientation.

122. IDLER (DR). Coexistence of a fishery and a major industry in placentia bay. Chem Can 1969;6;21(11;1969;16-21 [Commer Fish Abstr 23(6);1970;25(9.19); Chem Abstr 72;1970;211 Ab No.24362g].

The fishery plant operation and the nature of the pollution of Placentia Bay are discussed. The toxicity to herring cod, and lobsters of P and others effluent materials present, esp. CN, NH_4F and SO_2 is discussed briefly. The principal steps taken prior to the reopening of the fishery are examd. The scope and nature of the bottom sediments and the salient points that resulted in the decision to suction dredge the polluted area are discussed briefly. The lessons learned from this problem and the scientists role in the prevention of pollution are stressed.

123. KRISHNASWAMI (SK) and KUPCHANKO (EE). Relationship between odor of petroleum refinery waste water and occurrence of 'oily' taste-flavour in rainbow trout, Salmo gairdnerii. J Wat Pollut Control Fed 41;1969;R189-R197.

A relationship was found between the threshold odor No. (TON) of the waste water and the occurrence of oily taste-flavour in the fish. The oily taste, as detected in the cooked fish by a taste panel of <3 members can be prevented by reducing the TON of the water water so that its final value, after appropriate dilution in the receiving stream is >0.25.

124. PODUBA (ZP). Effect of biologically purified waste waters of the paper and pulp industry on fish. Chem Abstr 72(13);1970; 93210t. [CommerFish Abstr 23(11);1970;22(9.19)].

125. NIES (CF). Egg laying house wastes. Pardane Univ. Eng Bull Ext Ser No.129(Pt.1);1967;334-41.Eng) [Chem Abstr 70;1969;238 Ab No.4 519c].

The treatment processes available for disposing of the waste products from an egg production unit are discussed briefly and then a system in which the waste solids are dried and bagged and the liq. effluent used for irrigation is described in detail. From such a production unit the solid waste is a combination of wet chicken manure and a continual accumulation of dead hen carcasses. The liq. effluent is the unused drinking water often contaminated with uneaten feed. Treatment processes considered included: drying, controlled anaerobic digestion, land disposal, incineration, aerobic treatment, sedimentation, centrifuging, and hydroponic farming. The treatment method chosen entailed the dry collection of the manure and carcasses which were then passed to a combined crusher and drier. Five such units operate satisfactorily and each produces 2800 lb/day of dried product which is bagged and now finds com. outlets.

126. BENDIXEN (TW) and others. Cannery waste treatment by spray irrigation-runoff. J Water Pollut Control Fed 41;1969;385-91.

A spray runoff technique, developed at a tomato processing plant in Ohio, using soil with poor natural drainage for the treatment and disposal of process wastes, is described. The waste is sprayed at the top of uniformly graded, grassed slopes (5%) and the runoff is collected in waterways, discharging into a natural water course. During 1964 and 1965, 30-40% of the applied waste ran off, 30% was lost by evapotranspiration, 25% was stored in the soil or lost through percolation and 5% evaporated directly from the spray. Removals of COD, phosphates and suspended solids were of the order of 95, 93, 84 and 97% respectively.

TREATMENT OF INDUSTRIAL WASTE WATER

127. COMPTON (DW) and others. Application of ionizing radiation to the treatment of waste waters and sewage sludge. Nuclear Science Abstr 24(6);1970;990 [Commer Fish Abstr 23(3);1970; 26(9.19)].

From symposium on utilization of large radiation source and accelerators in Industrial Processing, Munich, Germany, 18-22 August 1969. Available from the clearinghouse for Feder Scientific and Technical Information. US Department of Commerce, Springfield, Va. 22151.

The authors concluded that irradiation is not an economical comparative process for oxidation of organic impurities in waste waters nor as a conditioning agent in sludge filtration. They found, however, that irradiation does produce potentially useful effects in enhancing the settling of sludge, and they are doing further work along this line.

128. HAGER (DG). and JOYCE (RS). Calgon patents chemical/physical process for wastewater treatment. Environment Sc & Tech 4(8);1970;652 [Commer Fish Abstr 23(12);1970;32(9.19)].

The polymer-carbon system summarized in the patent comprises treating raw sewage with a flocculant (organic or inorganic) to separate the solids from the liquid, separating the effluent from the liquid, separating the effluent from the flocculated solids, passing the effluent through at least one bed of activated carbon, and periodically back-washing and regenerating the activated carbon. With the system, both secondary and teritiary quality water is produced. The three main advantages of the system are: its capital costs are about 16% less than those of conventional biological treatment systems for secondary treatment and 40% less for tertiary treatment; it removes from 90 to 95% of the organic pollutants (including pesticides, phenols, dyes, polyols, and TNT); it takes 85% less land and other advantages: are: its process is unaffected by toxic chemicals or by sudden changes in pH resulting from shock loads of acids or alkalies; it reduces sludge handling, since it incorporates no microorganisms to die off and produce solids; it is odor free, thus the clarification adsorption plants can be located anywhere.

POLLUTION, PESTICIDES

129. HEADLEY (JC). Pesticide problem. Annotated bibliography. Mo Agr Exp Stan. Res Bull 70;1970;53(Eng) [Chem Abstr 72;1970;241 Ab No. 120351y].

A bibliography of literature from a wide variety of sources pertinent to the problem of environmental pollution assesed with widespread use of chemical pesticides.

130. ABELSO.. (PH). Methyl mercury. Science 169(3942);177 ;237 [Commer Fish Abstr 23(11);1970;22(9.19)]. .

This articl discusses the pollution problems related to the production and use of mercury compounds. It also briefly describes some of the steps in the accumulation of ethyl mercury in fishes [Jensen S., and A. Jernelov, Biological Methylation of Mercury in Aqautic Organisms, Nature 223, 753 (1969)]

Industrial Wastes containing inorganic mercury compounds are converted into CH_3Hg^+ or $(CH_3)2Hg$ by anaerobic Organisms. $(CH_3)2H_g$ is volatile and passes into the water column from the sediment. It is converted to CH_3Hg^+ at low pH. The ion is soluble in water and is concentrated by living organisms of the lakes, usually appearing in the body lipids of the animals. The concentration in the fishes may, in part, come by way of the food chain, but apparently fishes may accumulate the ion directly. The concentration factor from water to pike fish is in the order of 3,000 or higher.

131. HEARNDEN (EH). Mercury pollution. Fisheries department acts quickly to safeguard public health. Fisheries of Canada 22(10);1970;3-6 [Commer Fish Abstr 23(11);1970;19(9.19)].

This article recounts the quick, decisive steps taken by the Canadian government to combat mercury pollution in Canadian fishing waters. When the first reports of mercury contamination in fish from the Saskatchewan River reached Ottawa in late November 1969, the Department of Fisheries and Forestry immediately placed all fish from the Saskatchewan River system under detention. Using an automatic absorption spectr-photometer, a team of scientists and technicians began analyzing the fish. Any that contained over 0.5 ppm mercury were destroyed in an incinerator; those that contained less were released for sale. Then the task of tracking down the source of the pollution began. By early May, a testing program that spanned the country was in full operation. Fishing grounds in upper Howe Sound, British Columbia; Lake Winnipeg Lake St.Clair; parts of Lake Huron and Lake Erie; and the St. Lawrence were closed to commercial fishing. Free loans were made available to fishermen suffering hardship due to the closures.

Addressing a meeting of the Canadian Manufacturers Association in Toronto on April , Fisheries Minister Davis said that, although the amounts of mercury in Canadian fish were alarming, the problem had been solved in time to arrest any real danger to human beings. Stating that the closures had been expensive for the government, he added: "Basically, the industry which caused the problem must solve the problem. It must not only improve its housekeeping but also make amends for sloppy practices in the past. It must clean up its operations and it must compensate others who have been hurt by its negligence.

132. MILLER (LL) and NARANG (RS). Induced photolysis of DDT, Science 169(3943);1970;368-70 [Commer Fish Abstr 23(11);1970;21(9.19)].

Use of solar energy may be a way to decompose halogenated pesticides in the environment. Unfortunately, these com pounds do not have an extinction coefficient high enough into solar region to induce environmental degradation. Another approach is to induce the decomposition of chlorinated hydrocarbons with other compounds that do adsorb light in the solar region. This paper reports on the dehalgenation of DDT [1,1,1-trichloro 2,2-bis(p-chlorophenyl) ethanol] by photolysis of a mixture of the pesticide and certain aromatic amines.

Apparently, the reactions involve a transfer of a photo-induced charge from the amine to the halide. Tritolylaminium chloride was produced from the photolysis of tritolylamine and carbon tetrachloride. Photolysis of a mixture of DDT and diethylaniline at 3,100 a yielded DDD [1,1-dichloro 2,2-bis(p-chlorophenyl-ethane], DDCO [p,p'-dichloro-benzophenone] and hydrogen chloride. Photolysis of DDT did not occur unless an inducer with a low ionization potential (such as diethylaniline) was present. The mixture of DDT and diethylaniline was stable in the dark.

133. PLIMMER (JR) and others. Photooxidation of DDT and DDE. Science 167(3914);1970;67-69 [Commer Fish Abstr 23(4);1970;26(9.19)].

The paper reports on the photooxidation of DDT [1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane] and DDE [1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene]. The two pesticides can be photooxidized in methanol. Free radicals are photolytically generated, and they may abstract hydrogen from the solvent, react with oxygen, or abstract hydrogen from unreacted substrate. The oxidation products include benzoic acids, aromatic ketones, and chlorinated phenols. The DDE also undergoes photocyclization, producing dichlorofluorene derivatives.

EFFECTS OF PESTICIDES ON ENVIRONMENTAL POLLUTION

134. Persistent pesticides and environmental quality. Columbia J Law and Social Problems 6(1);1970;122-43 [Commer Fish Abstr 23(9);1970;33(9.19)].

This article reports on the argument over the use of persistent pesticides. (A persistent pesticide, for the purpose of the article, is any of a number of synthetically produced compounds which, when released into the environment, retain their biological activity for a period of years). The continued contamination of the environment by these pesticides serves to illustrate the general lack of appreciation for the importance of a quality environment.

The article concludes that if the nation is to succeed in its desire for a quality environment, it must change the perspective of its laws. Where governmental agencies are directed to weigh the considerations in administering the law, the directions should be explicit as to environmental quality. Furthermore, the federal government should adopt legislative measures and coordinated agency actions that are consistent with a strong national policy of environmental quality. Finally the article concludes that if each problem of environmental pollution requires the amount of damaging evidence that was required before action was taken against persistent pesticides, then environmental quality is doomed to be an illusionary concept.

POLLUTION INFLUENCING FOOD

135. Proteins from pollutants making dollars out of dross. Chem Eng 76(9);1969;56, 58.

Outlines three processes for producing food and feed from waste materials viz., (a) cultivation of yeasts on wastes from potato processing and shell corn processing plants; (b) cultivation of microorganisms on a substrate of grass, bagasse, leaves and corn cobs, or even excelsion, newspapers, books, rags, towels or wood in urban areas; (c) bacterial conversion of waste sulfite liquors from paper industries into propionic acid, acetic acid, and vitamin B-12.

Utilization of various oilseed meals, pulses, and even leaves is also mentioned.

136. SCHMIDT-HEBBEL (H) and others. Fluorine content of food and beverages consumed in chile. Food Sc Tech Abstr 2(4);1970; 483(4G194) [Commercial Fisheries Abstr 23(10);1970;89(919)].

Anales de bromatologia V271;1969;p.29.

The distillation and the microdifusion techniques were used to separate the fluorine from food. The determination of fluorine was made by a colorimetric method.

Water, tea, wines, shellfish, fresh and canned fish and some fruits were analyzed.

The data obtained in the present paper were: 1.03 ppm of fluorine in water; 1.15 ppm in the tea infusion (beverage); 2.13 ppm in mollusc, 2.25 ppm in crustaceous; sea urch. in 3.03 ppm; 3.75 ppm in canned fish; 0.63 ppm in white wine. 0.44 ppm in red wine and 0.63, 0.35, 1.90 ppm in apples, oranges and pears, respectively.

137. STAVENGER (PL). Food industry and pollution. Food Tech 24(2);1970;121-22, 124 and 126.

Increased governmental regulation, development of more technological solutions to pollution problems shifts away from food products with high waste component costs, and changes in packaging strategy to lessen waste problems, are seen as solutions to pollution in the food industry.

138. VIEBAHN (WC). Pollution: scourge of the 'seventies. Problems of grain handlers and cereal processors examined. Northwestern Miller 277(5);1970;37-38, and 40.

Particle size of dust collected from different operations during grain handling and flour milling averages - 30 µm. Since most cyclone systems collect only 80-85% by wt. of dust of this particle size, 15-20% of dust produced escapes into the atm, equivalent to -2.25 grains/standard cubic ft (scf) which far exceeds the usual allowable limit of 0.3-04 grain/scf. A simple way of estimating emissions from the cyclones is to weigh the tailings for a 15 min period when the particular process is fully utilized. Dust control at truck and rail load out operations is essential to avoid pollution. Besides meeting official prescriptions, further advantages of efficient dust control are: operating loss is kept down, housekeeping and sanitation problems are minimized, neighbourhood complaints are reduced and employee morale is improved.

139. 800 ppm BOD reduced to daily average of 25. Food processing 30(8);1969;19.

A method is given for removing pollution from the waste from a fruit and vegetable processing organization. The solids, such as the peel and cores, are screened and used for landfill and the liquid waste is purified in two aerated lagoons when nitrate, phosphoric acid and lime are added. The waste is then transferred to a third lagoon for further aeration and finally to a fourth lagoon where the sludge particles drop to the botton.

140. AMES (P). DDT residues in the eggs of the osprey in the North Eastern United States and their relation to nesting success. Pestic, Environ. Their eff. Wildl. Proc 1965;87-97(Eng). [Chem Abstr 70;1969;212 Ab No. 86540p].

The osprey (pandion haliaetus) population in coastal connecticut has been declining for 9 years by 30% annually, owing to embryonic death before hatching (0.40-0.54 eggs hatch/nest). Hatchability and egg pesticide values were compared with those of an apparently stable colony in Chesapeake Bay, Md. (1.3-1.06 eggs hatch/nest). Osprey populations in Maine Massachusetts, Rhode Island, and New York are also declining DDT residues found were 350 r/egg (5.1 r/ml) in Connecticut and 205 r/egg (3.0 r/ml) in Maryland. Total DDT residues in fish from Connecticut nests were 5-10 fold higher than in Maryland ...

50 ppm. DDE and DDT in the diet rapidly produced residues in the eggs. In the few analyses completed, 50 ppm DDE caused a linear increase to 60 r/ml after 60 days; 50 ppm DDD caused a stable level of 3.5 r/ml in the eggs.

POLLUTION INFLUENCING FISH

141. ALABASTER (JS). Testing the toxicity of effluents to fish. Chem and Indus No.24;1970;759-64.

142. BLUMER (M) and others. Phytol derived C_{19} di and triolefinic hydrocarbons in marinezoo plankton and fishes. Biochem 3(10);1969;4067-74 (Eng) [Chem Abstr 71;1969;126 Ab No.120862v].

Three phytolderived olefinic hydrocarbons have been isolated from marine zooplankton and fishes. Their structures have been detd. by uv. ir, NMR and mass spectrometry and by combined gas chromatog and mass spectrometry of their ozonolysis products. They are the 2,10- and 5,10-diene and the 2,6,10-triene analogs of pristane(2,6,10, 14-tetramethylpentadecane). The presumed mode of formation of these and related olefins and their fate in the marine food chain and in marine sediments is discussed. Because of their relative stability, these and related hydrocarbons provide tracers for the study of dynamic processes in the marine food chain. These olefins are not present in ancient sediments and petroleum. They are valuable markers for the distinction between marine hydrocarbons derived from organisms and from oil pollution.

143. CHADWICK (GG) and BROCKSEN (RW). Accumulation of dieldrin by fish and selected fish food organisms. Chem Abstr 71(25); 1969;120983k. [Commer Fish Abstr 23(4);1970;24(?.1?)].

144. DREOSTI (GM). Fish solids from factory effluents - Whipping procedure for flotation. Fish News Intern 6;1967;53-54.

Fish material in fish factory effluent can be removed by flocculation and flotation. The most common method of achieving flotation is compression of minute bubbles of air into the liquor, followed by release of presence in the flotation tank.

The author has worked out, on a laboratory scale, a method of whipping, air into the effluent and then treating it with a flocculant. The floc usually rises to the surface in 5 mins. Good results were obtained with effluents containing upto about 0.8% of flocculable solids. The power requirement is very small (only 10 kw for aerating 50,000 gallons an hour.

145. LELAND (HV). Biochemical factors affecting toxicity of parathion and selected analogues to fishes. Food Sc Tech Abstr 2(4);1970;575 (4R117). [Commer Fish Abstr 23(9);1970;36 (9.19)].

The author found that the toxicity of parathion and its analogs to fishes was clearly related to the anticholinesterase potency of the respective oxygen analogs. Under some conditions, parts of the exposed fish may be unsafe for human consumption.

146. MOUNT (DI) and BOYLE (HW). Parathion - use of blood concentration to diagnose mortality of fish. Environmental science Tech 3(11);1969;1183-85. [Commer Fish Abstr 23;1970;19 (9.19)].

Diagnosis of specific causes of fish kills is often difficult. The present paper reports on the measurement of blood concentration of parathion as a diagnostic tool to detect fish mortality caused by acute exposure of the fish to parathion dissolved in water. Catfish, Ictalurus nebulosus (Le Sueur), were exposed to various concentrations of technical grade parathion (80 per cent active) dissolved in water for periods of up to 30 days. The Concentration of parathion in the blood correlated with that found in the water. Diagnosis of mortalities of catfish caused by acute exposure to parathion can be made by measuring the amount of unaltered parathion in the blood. Further research is necessary to determine if the method applies to other species of fish and to determine whether parathion occurs in higher concentrations in the muscle than in the blood.

147. SKERFVING (S) and others. Chromosome breakage in humans exposed to methyl mercury through fish consumption. Arch Environ Health 21(2);1970;133-9 [Commer Fish Abstr 23(12);1970;31 (9.19)].

The authors performed chromosome analysis on cells from lymphocyte from cultures taken from nine subjects who had consumed fish contaminated with methyl mercury at least three times a week for more than 5 years. The mercury levels in the fish ranged from 1 to 7 ppm Four older, healthy subjects were studied as controls. The exposed subjects had mercury levels in their red blood cells (mercury concentrations in red blood cells are considered the most reliable index available of exposure to methyl mercury) of between 21 and 370 μg/that is, from 2 to 40 ti higher than the unexposed subjects had. The rank correlation between the frequency of cells with chromosome breaks and the concentration of mercury was statistically significant (r=0.6; p=0.05). Because the frequencies of cells with chromosome breaks varied widely at the differen mercury levels, interpretation of the results is difficult Theoretically, however, methyl mercury induced chromosome damage in germ line cells could give rise to abnormal offspring.

148. SPRAGUE (JB). Measurement of pollutant toxicity to fish. I. Bioassay methods for acute toxicity. Water Research 3(11);1969;793-821. [Commer Fish Abstr 23(7);1970;26(9.19

This review paper describes profitable methods for measuring levels of pollutants lethal to aquatic organisms. The critical review is intended for students of scientists entering the field of toxicity testing of aquatic organis Three hundred and seventy five toxicity tests are reviewe

For 211 of the toxicity tests reviewed, acute lethal action apparently ceased within 4 days. The author recommends the incipient LC50 (lethal concentration for 50 per cent of the individuals on long exposure) as the most useful single criterion of toxicity. If this criterion cannot be estimated, he suggests the 4-day LC50 as a usefu substitute.

PESTICIDES INFLUENCING FISH

149. HOLDEN (AV). Organochlorine insecticide residues in salmonoid fish. Pestic environ Their eff wildl proc 45-53;1965 (Eng [Chem Abstr 70;1969;257 Ab No. 56689u].

examns. include fish from a lake contaminated by dieldrin,

Details are given of the concentrations of dieldrin and the DDT group of pesticide residues found in salmonids fro various sources, including dead fish from toxocity tests and from fish kills resulting from sheep dip contaminatior Other fish from hill streams and arable areas, and migratory fish from a polluted estuary. The possible biol. significance of the various residue levels to fish or predators, and the process of accumulation by fish from low aq. concentrations to considerably higher tissue concentrations are discussed.

150. JENKINS (CE). Radionuclide distribution in pacific salmon. Food Sc Tech Abstr 2(1);1970;127-8. Item 01429. [Commer Fish Abstr 23(10);1970;26(9.19)].

The following gamma-emitting radionuclides were detected a measured in four species of pacific salmon: ^{54}Mn, ^{60}Co, ^{137}Cs, ^{226}Ra, ^{22}Na, ^{40}K, ^{46}Sc, ^{51}Cr, ^{57}Co, ^{59}Fe, ^{65}Zn, ^{88}Y, ^{110m}Ag, ^{140}Ba, ^{152}Eu, ^{203}Hg, and ^{208}Tl. The concentration of the first two decreased in muscle tissue of salmon caught from Northwest Alaska through Southern Alaska to the Washington-Oregon coast by factors of about 1.5 to 3 and 4.5 to 12, respectively. The concentration of ^{137}Cs decreased only about 25 per cent. Concentrations of ^{226}Ra in the tissues of Alaskan salmon were high enough to cause natives who ate the fish to exceed their maximum permissible level. Among the factors affecting the distribution pattern of the radionuclides were the amount present in the Columbia River and the nuclear tests conducted by the Chinese.

151. FROM (PO) and HUTTER (RC). Uptake of dieldrin by isolated perfused gills of rainbow trout. J Fish Res Board Can 26(7);1969;1839-42 [Commer Fish Abstr 23;1970;16(9.13)].

The authors demonstrated the transfer of dieldrin (a chlorinated dimethanonaphthalene used as an insecticide) from environmental water into the vascular system of isolated perfused gills of rainbow trout. From the results obtained, the authors suggest that dieldrin and other related insecticides diffuse through the gills of fishes and are dissolved in the lipid portion of the plasm lipo-protein. They are then transported to and dissolve in the lipid portion of the various tissues. Because the insecticide is more soluble in lipid than in water, the concentration in the tissues of fish can attain levels far above that in the environmental water independent of any transport mechanisms.

152. ODUM (WE) AND others. DDT residues absorbed from organic detritus by fiddler crabs. Science 164(3879);1969;576-7 [Chem Abstr 71;1969;251 Ab No.21179w].

DDT and its metabolites accumulate in org. plant detritus within estuaries and many persist there for many years. The residues appear to be most abundantly assocd. with particulates having diams. of 250-1000μ. Detritus particles of this size are ingested by many organisms and assocd. DDT residues may enter diverse food chains. Fiddler crabs, Uca pugnax, were fed natural detritus contg. DDT residues (10 ppm) during an 11 day expt. and showed grossly modified behavior assocd. with a 3 fold increase in concn. of DDT residues in the muscle of the large claw.

NUTRITIONAL EFFECTS OF POLLUTION

153. KANWAR (JS). Agriculture and human environments. Sc & Cult 37(2);1971;76.

Irrigation and engineering works, exploitation of underground water, extensive use of fertilizers and pesticides, Industrial wastes can all become potential dangers to agriculture. Importance of preserving the existing genetic germ plasm and increasing productivity of human labour and natural resources is pointed out.

154. JELLIFFE (DB). Commerciogenic malnutrition? Time for a dialogue. Food Tech 25(2);1971;55.

The problems of child nutrition are highly influenced by infant feeding practices. These practices are developed either through nutrition education programs or through the advertising compaigns presented by industry. Many advantages can be attributed to these programs, but it has also been through these programs that many harmful effects have emerged. Fortunately the nutrition education programs have ...

a real need to reconsider where nutrition education and persuasion are going, if infant foods truly designed for the economic, cultural and hygienic circumstances of less developed areas are to be developed.

POLLUTION, BIOLOGY

155. SINHA (UK) and JOHRI (BM). Pollution. A biological problem. Sc & Cult 37(2);1971;69.

Spreading and increasing pollution can be brought against by enforcing stringent laws by a world government, or by educating the masses in basic principles of biology.

It is stated that the average DDT content in bodies of Indian is about 25 ppm whereas in the Westerner it is only 5-12 ppm.

156. IGNATIADES (L) and DECASTRO-KONTOS (F). Ecology of fouling organisms in a polluted area. Nature 225(5229);1970;293-4 [Commer Fish Abstr 23(4);1970;25(9.19)].

The growth and development of fouling organisms in polluted areas is relatively unexplored. In 1961, Callagh reported an extensive kill by crude or fuel oil by oysters and cockles in certain beds along the French and English coasts. Yet in 1950, Mackin had reported that oysters are very tolerant of crude oil overlying the water emulsified in the water, or periodically sprayed on the shellfish themselves. The present authors did the work reported here to determine the extent of attachment and growth of fouling organisms in the very polluted port at Piraeus. Using wooden settling blocks suspended from a raft anchord at the dock, they monitored the temperature, salinity, dissolved ak oxygen content, transparency, and light penetrability of the water at monthly intervals from May1968 through April1969.

The predominant fouling organisms were Bugula simplex, Hydroides norvegica, Ciona intestinalis, Balanus amphitrite and Mytilus edulis. Their maximum growth occurred from May to November, when the water temperature was from 22° to 26°C. From January through March, when the water temperature was from 14° to 16°C, they were virtually absent. They were resistant to the toxicity of the oil polluted water, and those that were filter that feeders did not seem to be affected by great amounts of suspended mud. Green and blue light was absorbed much more decidedly in the polluted area of the port than in the nonpolluted area outside the port. Since strong light has been shown to repel the attachment of certain fouling organisms (Callame, 1965), the authors assume that the poor light conditions, caused largely by

157. SARABHAI (VA). Pollution and human environment. Sc & Cult 37(2);1971;73.

Draws attention to three problems, viz. (1) thermal pollution (2) use of DDT, (3) replacement of internal combustion engines by elective traction engines.

EFFECTS OF POLLUTION ON ECOSYSTEMS

158. WOODWELL (GM). Effects of pollution on the structure and physiology of ecosystems. Science 168(3939);1970;429-433. [Commer Fish Abstr 23(10);1970;28(9.19)].

The accumulation of toxic substances in the biosphere causes complex though predictable changes in the structure and the function of natural ecosystems. The structural changes in both plant and ratio of gross production to total respiration, and losses in the nutrient inventory. Only a few studies (those concerned with the effects of ionizing radiation, persistent pesticides, and entrophication) have clearly shown the pattern of these changes. Using the effects of radiation as a model, the author demonstrates the pattern of change actuated by chronic radiation and shows the parallel between these effects and those of fire, oxides of sulfur herbicides, and pesticides. He also shows that the ecological effects of pollution can be anticipated in detail.

POLLUTION INFLUENCING PLANTS

159. MACLEAN (AJ) and others. Extractability of added lead in soils and its concentration in plants. Can J Soil Sc 49(3); 1969;327-34 (Eng) [Chemical Abstr 72;1970;232 Ab No.2646a

The concentrations of Pb in 5 species of plants increased with proximity of the sampling sites to a well travelled high way. The Pb content of oats and alfalfa grown in 4 soils pretreated with $PbCl_2$ in pot tests varied inversely with the org. matter content and pH of the soils. The amts. of Pb taken up by the plants were reduced upon addn. of phosphate or of lime to the acid soils. Furthermore, the beneficial effects of org. matter, phosphate, and lime in reducing Pb in the plants were usually in accord with corresponding redns., in extractable Pb in the soils as measured in N neutral NH_2OAc and 0.1 M $CaCl_2$.

160. MALONE (TC). In vitro conversion of DDT to DDD by the intestinal microflora of the Northern anchovy, Engraulic Mordax. Nature 227(5260);1970;848-9. [Commer Fish Abstr 23(12);1970;34(9.19)].

The purpose of this study was to establish whether the intestinal microflora of the northern anchovy can dechlorinate DDT and to determine the relative importance

∠(little or no DDE was formed). This rapid metabolism of DDT to DDD

of bacterial and fungi in the process. The fungi and the bacteria of the intestinal contents of the fish rapidly converted DDT to DDD∠may be important in the survival of fishes because DDD is less toxic than DDT, and the degradation and assimilation of ingested food require several days. The results suggest, also, that although both bacteria and fungi metabolize DDT to DDE, the fungi are primarily responsible for further degrading DDD to a water-soluble product in anaerobic conditions.

161\. FUGIWARA (T). Sulphur accumulation and development of injury signs in plants absorbing sulphur dioxide from the atmosphere. Nippon Shokubutsu byori gakkaino 34(5); 1968;336-41 [Chem Abstr 70;1969;89 Ab No. 94931f].

Rush and buckwheat, plants highly sensitive to SO_2. were exposed to SO_2 at 3 concentrations for 30 or 50 days. In any given gas concentration, both plants accumulated by absorbing SO_2. In rush, the S contents at the time when the tip-burn was 3% of the total length after exposur to 0.26, 0.13 and 0.065 ppm gas were about 0.4 - 0.8 and respectively. In buckwheat, the S content at the times of appearance of leaf injury caused by exposure to 0.26, 0.13 and 0.065 ppm gas was about 0.6, 0.75, and 1.2%, respectively. Control plants not treated with gas always contained about 0.2%S. Thus, the lower the gas concentration, the higher the level of S in the plant needed for the appearance of injury.

162\. DE CORNIS (L) and others. Absorption and accumulation of atmosph fluorine by the leaves of some herbaceous plants. Ann Physiol Veg 10(4);1968;251-62 [Chem Abstr 72;1970;86 Ab No. 107925u].

Plants used were tomatoes, tobacco, and beans, and they we exposed to air contg. 11-309 mg HF/m^3. Absorption of HF w always proportional to concentration, time of expsoure, and relative humidity. In tobacco, HF accumulated in the margins and tips of the leaves and these are areas which s burning when exposed to HF.

BIOLOGICAL EFFECTS OF PESTICIDE POLLUTION

163\. MENZIE (CM). Metabolism of pesticides. Spl. Sc Rep Wildlife No.127 1969;486 [Commer Fish Abstr 23;1970;23(9.19)].

This is a review of information concerned with the metabolism and decomposition of pesticides. Such information is useful to research workers and administrators who are concerned with the safe and effective use of pesticides in our environment. The disappearance of a pesticide takes place by leaching, volatalization, adsorption, decomposition, or metabolism. The use of a particular pesticide may depend upon the effects of one or more of these processes.

The metabolism and decomposition of pesticides is important because (1) the duration of the toxic action can be related to the rate and manner in which the compound is metabolized; (2) the rate of elimination from the body is dependent upon the physicochemical properties of the metabolic products; (3) the ability of a compound to reac a site of action may be limited by the rate at which it is metabolized and the character of the metabolic products; and (4) the toxicity of a compound can be decreased or intensified upon conversion to a metabolite

The report discusses 333 pesticides and contains a biblio graphy of 1,792 references.

164. NIKOLAEVSKII (VS) and SUSLOVA (VS). Effects of sulphur dioxide and sulphuric acid on physiological and biochemical processes in plant leaves. Uch Zap Perm B/ Gos Univ No.175;1967;12-17 (Russ). [Chem Abstr 71;1969;108 Ab No. 57716h].

Maple trees near a Cu smelter, showed less leaf damage than birch. These differences in gas resistance coincide with differences in the changes occurring in oxidn. redn. and enzyme activities of leaf exts. exptl. exposed to H_2SO_4 and SO_2. At first the reducing capacity rose in maple, but in birch the oxidative capacity rose. Peroxida activity rose higher in birch than in maple and it was inactivated at a lower H_2SO_4 level in maple than in birch The occurrence of a peak in oxidative activity after peroxidase is inactivated indicates activation of the cytochromeoxidase and other oxidative systems. The oxidn redn. regime is affected by H_2SO_4, not only through changes in pH but also biochem. The two S compds. were similar in effect. Both caused a rapid inactivation of catalase and the peculiar behavior of peroxidase noted for the 2 spices.

165. LI (MF) and others. Toxic effect of elemental phosphorus on L-cells cultivated in suspension. Canad J Zool 48(1);19 133-8. [Commer Fish Abstr 23(6);1970;25(9.19)].

The death of great numbers of herring (Clupea herengus) in Placentia Bay, Newfoundland, has been attributed to pollution by elemental phosphorus. In 1960, Isom, reporting on the toxicity of elemental phosphorus to fish, indicated that the tolerance limit for bluegill (Lepomis mecrocchirus) is about 0.1 mg/l. for 48 hours. Other species of fish are known to be sensitive at much lower levels. In 1968, Jo son reported that the sensitivity of different species of fish to pollutants varies. These reports emphasize the difficulty of using fish for bioassay of pollutants indicate a need for a standard bioassay system divorced from the effects of pollutants on marine life. In the present report, the authors used L cells grown in spinne culture to examine the effects of elemental phosphorus o cell replication and cellular morphology.

The rate of cell replication was progressively reduced as the concentrations of phosphorus were increased. When the cultures were treated with phosphorus at level o 0.31 mg/1,

Cell replication was inhibited about 75 per cent; at a level of 1.25 mg/1, replication was completely inhibited. The calculat correlation coefficient between phosphorus concentration (x) and per cent inhibition (Y) was significant at the 1 per cent level. The relation was linear and could be expressed by the equation Y = 10.42 X + 75.79.

The much more moderate effect of phosphorus on cell viability than on cell replication suggested that phosphorus may not totally destroy or kill the cells. To clarifyq the mechanism of action, the authors used the Maygrunwald Giemsa staining technique on ribonucleoproteins and deoxyribonucleoproteins and the Fenlgen technique for demonstrating deoxyribonucleic acid. Cells treated with various concentrations of phosphorus showed typical cytopathic changes. The control cells stained well and were uniform in size and shape, whereas the treated cells increased in size and had a tendency to loose their dye-binding capacity. These phenomena increased as the concentration of phosphorus was increased. The well defined cytoplasmic membrane that could be seen in the control cells was not intact in the treated cells. The cytoplasm of these cells lost its homogeneity and became liquified; the enlarged nuclei with vacuolated nucleoli became hyperchromatic. Cells exposed to phosphorus forme multinucleated giant cells, and some of those that were undergoing mitosis seemed to be arrested in metaphase, short, thick chromosomes were distributed throughout the cell.

166. SMITH (CW). Effects of environmental pollutants on growth and proline content of plant and animal cell cultures. 1968;86(Eng) Avail Univ. Microfilms Ann Arbor Mich Order No. 68-17,489 From Diss Abstr B1968;29(6);1965 [Chem Abstr 70;1969;205 Ab No. 70882h].

167. TENNEY (M) and others. Algal flocculation with synthetic organic polyelectrolytes. Amer Chem Soc Div Water Air Waste Chem Gen Pap 8(1);1968;103-11 (Eng) [Chem Abstr 71;1969;289 Ab No. 116343j].

Although environmentally controlled algal systems are finding appreciable application in the treatment of waste waters, particularly for extg. the fertilizing elements of N and P, the overall removal efficiency of these systems are frequently limited by insufficient consideration to th problem of sepn. of the microorganisms from the liq. phase after they xxx have fulfilled their metabolic role. In

order to achieve removal of both inorg. pollutants by th process, the task of microorganism sepn. must assume a r of importance at least equal to that of the control of the metabolic activities of the algae. The purpose of t research was to investigate the feasibility of sepg. alg from otherwise treated waste water by chem. floculation techniques by utilizing the chem. flocculants to aggrega the discrete algal cells into packets of such magnitude that they are capable of subsiding from suspension under quiescent conditions allowing thus for the discharge of clear supernatant liq. Both batch and continuous flow lab. scale algal culturing reactors were employed as a source of mixed populations of algae (Principally chlore Representative synthetic org. polyelectrolytes (cationic nonionic and anionic) were examd. with respect to their suitability as legal flocculants.

168. FERNANDEZ del RIEGO (A). Determination of arsenic in marine organisms Chem. Abstr 71(11);1969;46988x. [Commer Fish Abstr 23;1970;24 (9.19)].

The reaction that produces arsenamine with Ag diethyldithiocarbamate dissolved in pyridine was utilized for the detn. of As in diffierent marine species, many of com. interest. The reddish purple soln was measured photometrically. Considerable As variation was found in different species. The percentage of As found within the same species was variable and depended on the habit When a group of animals of the same species was divided into 2 parts. One of which was analyzed immediately and the other was placed in an aquarium was more than twice that found in the other group. Pelagic fish contained, in general, more As than did benthic fish. The plankton content of As varied with the time of year. The As content of Arenicola marina was very low, whereas in Nereis the As content was relatively hi Some species of mollusks were low in As, whereas others were high in the lean species. Among crustaceans analy the As content of Portunus puber and Pollicipes cornuc was max. and that of Carcinus meenas was relatively hig

169. KOBAYASHI (K) and AKITAKE (H). Studies on the metabolism of pentachbrophenate, a herbicide, in aquatic organisms. I. Turnover of absorbed PCP in tapes philippinarum. Bull Jap Soc Sc Fish 35(12);1969;1179-93 [Commer Fish Abstr 23(6);1970;24(9.19)].

^{14}C-labeled PCP (Pentachlorophenate) dissolved in sea water was rapidly absorbed by the shellfish Tapes philippinarum. It quickly became distributed throughou the mollusk's various organs, being especially noticabl in the liver and the organ of Bojanus, thence, presumab it was quickly eliminated. Most of the accumulated PC in the tissues was not decomposed, whether in the free the bound form.

170. BRYAN (GW). Effects of oil spill removes (detergents) on the gastropod Nucella lapillus on a rocky shore and in the laboratory Chem Abstr 72(13);1970;64090y [Commer Fish Abstr 23(9);1970;32(9.19)].

The effects of oil spill removers on a population of the dogwhelk N. lapillus were studied at Porthlevem, where heavy oil pollution had occurred. Nucella is usually resistant to detergents, but at Porthleven the species was wiped out in the harbour and the majority were killed on the nearby reef. Growing animals which recovered were later found to have developed growth disturbances in the shell. This was an indirect effect of the detergent, due to interference with the ability of the animal to feed and with the availability of food. Recolonization of the reef was rapid and depended largely on the survival of some very young animals in the sublitoral zone. In contrast recolonization of the outer harbor, where the species was wiped out, was slow during the first 2 years and was dependent on lateral movement of animals from the reef. If the detergent treatment of the reef had been heavier, the species would have been wiped out there as well and would have been slow to recover.

POLLUTION EFFECTS OF PESTICIDES ON FISH

171. COX (JL). Accumulation of DDT residues in Triphoturus mexicanus from the gulf of California. Nature 227(5254);1970;292-3, [Commer Fish Abstr 23(10);1970;27(9.19)].

Robinson et al (1967) have theorized that the presence of DDT residues in fish cannot be accounted for in the same way that it can in mammals and birds, since fish probably do not produce water soluble metabolites. The metabolic precursors of the water soluble metabolic p,p'-DDA and DBP are found in measurable quantities in known metabolizers; they have not been found in fish. Moreover, fish take up DDT residues through the skin or the gills as well as along with the food and pass them out into the water again. Just how important this diffusive process across the gills is in the concentration of residues in the tissues of fish is not clearly understood. Earlier workers have assumed that the concentration is governed by an equilibriu between inward and outward diffusion. More recent workers, however, have found that fish progressively accumulate ^{14}C-DDT from water without any equilibrium point's being reache If the diffusive loss of residues to water is insignificant relative to the residues assimilated from the stomach contents, then older, larger fish should have higher concentrations of the pesticides than younger, smaller fish would. If, on the other hand, there is a diffisuion equilibrium between residues in the body and those in the water the size of the fish would not affect the concentration in the body, given a fixed homogeneous concentration in the ambient water.

To obtain information about the relation between fish size and the concentration of pesticide residues; the author analyzed 20 samples of Triphoturus mexicanus that had been caught by midwater trawl in an area in the Gulf of California relatively remote from zones of pesticide application. The fish were weighed and sorted into groups of narrow size range. Then the lipid fraction containing the pesticide was extracted with very pure n_hexane. Residues were identified by multiple-column gas-liquid chromatography. The findings are tabulated below.

Number of Samples	Fish	Weight range (mg)	Total concentration (parts/10^9 ± s.e.)	Concentration DDT (per cent)	DDE	DD
1	1	996	14	36	36	2
1	2	2,483	26	62	27	1
4	22	29-711	31 (± 10)	73	20	
9	23	29-1196	37(± 10)	52	35	1
1	5	378	46	76	15	
1	2	635	58	85	10	
4	64	21-867	45 (± 24)	64	23	1

These data show that total residue and DDE concentrations increased as the weight of the fish increased. Thus the cumulative_assimilation hypothesis appears to be valid for T. mexicanus.

172. MATTON (P) and LaHAM (QN). Effect of the organophosphate dylox o rainbow trout larvae. J Fish Res Board Can 26(8);1969; 2193-2200 [Commer Fish Abstr 23;1970;24(9.19)].

Organophosphates, because of their lower toxicity to fish and mammals and because they are rapidly degraded to harmless products are gradually replacing chlorinated hydrocarbon insecticides, organophosphate poisoning in fish and mammals is associated with the inhibition of acetylcholinesterase in the neuromuscular and brain tissue The purpose of the present study was to determine whether organophosphates have other effects besides inhibition of cholinesterase.

Treatment of 1-inch rainbow trout larvae with the organophosphate Dylox (O-,O-, Dimethyl 2.2.2.-trichloro_1-hydroxyethyl phosphonate) produced marked acetylcholinestc inhibition that was reflected by their abnormal behaviour patterns. Pathological changes took place in the heart, liver, blood cell pseudogills, and muscular tissue that could not be explained on the basis of acetylcholinesteras inhibition.

173. REHFELD (DH) and PRATT (DE). Influence of organophosphate insecticides on ascorbic acid oxidation in aqueous systems. J Food Sc 34(6);1969;551-3 [Commer Fish Abstr 23(7);1970; 26(9.19)].

Biodegradation of pesticides is brought about by reactions involving oxidation, reduction, and hydrolysis-all of which reactions are catalyzed by enzymes, by metals and by oxidizing and reducing agents. The present study was carried out to determine if organophosphate insecticides and their breakdown products effect ascorbic acid oxidation in vitro.

Aqueous systems at pH 2.2, 4, 6, and 8 and containing ascorbic acid and various levels of organophosphate insecticides were prepared, and the rate of ascorbic acid oxidation was measured polarographically.

The organophosphate insecticides tested showed antioxidant activity. Malathion, in the presence of copper ions, lost its antioxidant activity when EDTA (ethylenediaminetetra-acetic acid) was added. Oxygenated, oxidized, and hydrolyzed organophosphate insecticides retained some antioxidant activity. The phosphate moiety of malathion probably is responsible for the antioxidant activity. The authors postulate that the antioxidant activity of organophosphate insecticides must be due to the ability of the phosphate grouping to chelate metal ions.

174. REINHERT (RE). Pesticide concentrations in great lakes fish. Chem Abstr 73(1);1970;2963x [Commer Fish Abstr 23(10); 1970;28(9.19)].

During the past 4 years the Ann Arbor Great Lakes Fishery Lab. of the Bur. of Com. Fisheries has been monitoring insecticide levels in fish from the Great Lakes. The 2 insecticides found in all Great Lakes fish have been DDT (DDT, DDD, DDE) and dieldrin. Fish from Lake Michigan contain 2-7 fold as much of these insecticides as those from the other Great Lakes. Insecticide levels calcd. on a whole fish basis show a marked difference from species there is also an increase in DDT and dieldrin levels with an increase in size. If these insecticide levels are, however, cacd. as ppm of insecticide in the extractable fish oil, the differences between size groups becomes considerably less. Lab. Expts. indicate that fish can build up concns. of DDT and dieldrin at the ppm level from parts per trillion concentrations, in the water.

175. Surface slicks contain pesticides. Austral Fish 29(6);1970;18-9 [Commer Fish Abstr 23(12);1970;35(9.19)].

"Surface slicks" are calm streaks or patches on the otherwise rippled surface of lakes, coastal waters, and open seas. They may be up to several miles long and over 100 meters wide. Researchers at the Rosentiel School of Marine and Atmospheric Sciences, Miami, Florida, have found that the concentration of pesticides within these slicks is 10,000 times that in the surrounding water. Thus the fish that feed on plankton concentrated in the slicks, and the birds that feed on the fish, are exposed to an immensly more concentrated dose of pesticides than are fish in other waters.

Also discussed in the article are findings concerning the high pesticide content of atmospheric dust that had cros 4,000 miles of open ocean and the pesticide content of water; and the effect of environmental conditions on the pesticide uptake of fish. With the new test procedure, which prevents the fixation of a chlorinated pesticide to the test container's walls and reduces the amount of test solution lost as a vapor, much of the existing inconsistency of the recommended levels of chlorinated pesticides that fish can tolerate will be eliminated. In the experiments on the rate of pesticide extraction from the water by fish, the researchers found that the concentration of pesticide in the fish's blood is not a dependable indicator of the level of toxicity. Temperature, salinity and pH affect the rate of extraction by a factor of 5 to Using a one step procedure developed at the School, the researchers rapidly and precisely measured the amount of dieldrin in the gills and liver of the experimental fish. The procedure has proved successful for detecting the entire pesticide content in tissue samples of the brain, blood, liver, gill, intestine, and muscle of fish. Moreover, it permits indefinite storage of the tissue samples for later analysis by gas chromatography.

176. SOLON (JM) and others. Effect of sublethal concentration of LAS on the acute toxicity of various insecticides to the fat head minnow (Pimephales promelas rafinesque). Water Research 3(10);1969;767-775 [Commer Fish 23(7); 1970;26(9.19)].

Because a wide variety of toxicants may be present in surface waters, there is a need for information on the combined toxicity of these contaminants to fish and other organisms. This paper reports on the acute toxicities of DDT, endrin, and parathion in the presence and absence of linear alkyl benzene sulfonate (LAS) under constant flow conditions. When the fathead minnow was simultaneously exposed to lethal concentrations of parathion and a sublethal concentration of LAS, the two compounds showed a synergistic toxic action. Similar tests for DDT were inconsistent, and the variability of DDT toxicity appeared to be too great to accurately demonstrate any synergistic action with LAS. Endrin and LAS showed no syngerism between the two compounds.

177. WHEELER (WB). Experimental absorption of dieldrin by Chlorella. J Agri Food Chem 18(3);1970;416-19 [Commer Fish Abstr 23(9);1970;34(9.19)].

This study concerns the interactions between insecticides and algae. The authors demonstrate the absorption of dieldrin by Chlorella pyrenoidosa. Dieldrin penetrated the algal cells rapidly and a maximum level per cell was reached within 6 to 24 hours after the cells were exposed to the insecticide.

178. WILLIAMS (PM) and McGOWAN (JA). Bomb carbon-14 in deep sea organisms. Nature 227(5256);1970;375-6 [Commer Fish Abstr 23(11);1970;20(9.19)].

The radiocarbon activity of the inorganic carbon in surface sea water reflects the input of carbon-14 into the atmosphere from tests of nuclear weapons. Incorporation of this carbon-14 throughout the marine food chain can be used to determine the rate of cycling of organic carbon from the euphotic zone into the deep sea and the bottom sediment. Examination of two samples of zooplankton collected on the surface and of six samples of bathypelagic fish and crustacea caught at depths ranging from 400 to 2,100 m. indicated that the radiocarbon activity of surface zooplankton is basically that of the surface carbonate and bicarbonate. It showed that biocarbon can in some instances flow rapidly downward from the euphotic zone into the realm of deep dwelling organisms. In other instances, the low activities of bathypelagic specimens suggest that some food chain different from those previously reported may operate to provide certain organisms with a carbon source that is older than the surface, biocarbon.

179. KEITH (J). Insecticide contaminations in wetland habitats and their effects on fish eating birds. Pestic Environ Their Eff Wildl Proc 1955;71-85(Eng) [Chem Abstr 70;1969;257 Ab No. 56691p].

An unusual mortality of fish eating birds occurred at the Tule Lake National Wildlife Refuge in California between 1960 and 1962; over 1100 dead birds of 10 species were found. Investigations of the mortality indicated that the birds died as a result of exposure to toxaphene, applied to adjoining agricultural areas, transported to the refuge in waste irrigation water, and accumulated in fish eaten by the birds. Toxaphene was used in agriculture for only 3 years 1958-60, and by 1962 residues were no longer found in the marsh habitat. However, results also showed that a potentially hazardous contamination of DDT and its metabolites was present in the birds and environment; sampling for insecticide residues was undertaken at 4 waterfowl refuges, each representing a somewhat different set of environmental conditions. DDT residues in water at each refuge were relatively low, but filtered samples showed that residues in suspended material were 10,000-

-20,000 fold greater than those in the filtrate. Much of the suspended material was org. matter, an important source of energy for the ecosystems. In environments with invertebrates, DDT residues were relatively low in sediments and high in fish, whereas residues in vegetation were highest where invertebrates were absent. There is no evidence that exposure of pelicans to DDT influences the population dynamics of the birds.

PESTICIDE POLLUTION EFFECTS ON MAMMALS

180. ANAS (RE) and others. Organochloride pesticides in fur seals. Chem Abstr 73(1);1970;2958z. [Commer Fish Abstr 23(11); 1970;22(9.19)].

Samples of liver and brain tissue from 30 northern fur seals (Callorhinus ursinus) and 7 fur seal fetuses that were collected on the Pribilof Islands, Alaska, in 1968 and off the Washington coast in 1969, were analyzed for organochlorine pesticides. These compds. were found in all of the fur seals and in 3 of the fetuses. Polychlorinated biphenyls (PCB) were not detected. Of 30 samples of liver tissue from the seals all contained DDE; 21, DDD; 24, DDT; and 3 contained dieldrin. Of the 30 brain samples all contained DDE 5, DDD, 4, DDT; and none contained dieldrin. DDE was present in liver tissue from 3 of the fetuses, and in brain tissue from 2.

181. KOEMAN (JH) and VAN GENDERN (H). Residues of chlorinated hydrocarbon insecticides in birds and mammals in the Netherlands. Pestic Environ Their Eff Wildl Proc 1965;99-106(Eng [Chem Abstr 70;1969;257 Ab No. 56692q].

Birds of prey and fish eating birds in the Netherlands have accumulated large amounts of different chlorinated hydrocarbon insecticides. In some cases (buzzard barn owl), the death of the animal or its bad condition was probably due to the insecticides; in other cases, the tissue levels were high enough to consider these animals to be in danger of poisoning. Environmental contamination by these insecticides in coastal habitats has probably contributed to the decline in population density of spoonbills and terns.

182. DALEZIOS (J) and others. Aflatoxin P-1; a new aflatoxin metabolite in monkeys. Science 171(3971);1971;584.

A new phenolic derivative of aflatoxin B-1, appearing mainly in conjugated form was identified as the principal urinary metabolite of afltaoxin B-1 in rhesus monkeys. Its identification in human urine might facilitate estimation of aflatoxin exposure in human populations.

POLLUTION, CONTROL

183. HUBSCHMAN (JH). Lake erie: Pollution abatement then what? Science 171(3971);1971;536.

Even if the pollution problem is solved by adequate treatment of muncipal sewage, Lake Erie would still be faced with the problem of entrophication, or increasing concentration of biological nutrients. The author suggests that large scale harvesting of suitable benthic, invertebrate species could be one way of removing biomass from the entrophying system. Suitable species of molasses and crustaceans that would thrive in Lake Erie could probably be found after worldwide screening.

184. NEVINS (RG). Toward a better environment. Ashrae J 13(3);1971;27.

All pollution problems have their roots in the increasing human population which is confined to a planet with limited-albeit largeresources. Some ways will have to be found to recycle solid wastes and other wastes to keep this planet habitable.

185. Pollution control news and notes. Food Tech 25(2);1971;24.

186. LaMOTTE (C) and others. Pollution control report part 1. Ocean Industry 5(6);1970;39-61. [Commer Fish Abstr 23(10);1970; 27(9.19)].

1. LaMotte (C): The US plan to control water pollution 39-4

2. Wright (MA): Notes on Industry's oil spill control activities 46-148.

3. Tubb (M): "Control of oil spills-Recent technical Developments: 48-61 (continued in part 2).

For further details see Commercial Fisheries Abstracts.

187. TUBB (M) and others. Pollution control report - part 2. Ocean Industry 5(7);1970;39-61 [Commer Fish Abstr 23(12);1970;33 (9.19)].

3. Tubb (M): Control of oil spills-Recent technical developments 38-40; (continued from part 1).

4. Searle (WF): Two oil spill control system tailored for specific tasks 45-49.

5. Milz (EA). Evaluating oil spill control equipment and techniques 40-44.

188. Pollution control report part 3. Ocean Industry 5(8);1970;31-42. [Commer Fish Abstr 23(12);1970;33(9.19)].

1. Anonymous: Is the earth's oxygen supply treatened by pollution of the sea, 31-32.

2. Anonymous: Using chemicals for cleaning up oil spills, 35-40.

3. Picard(S): design of a depolluting ship; 40-41.

189. TUBB (M). Pollution control report Part 4. Highlights of on-going research in pollution. Ocean Industry 5( );1970;95-98 [Commer Fish Abstr 23(12);1970;34(9.19)].

190. What is new in aids for pollution control. Food Tech 25(2);1971

ENVIRONMENTAL POLLUTION CONTROL

191. JORDAN (FJE). Recent developments in international environmenta pollution control. McGill Law Journal 15(2);1969;279-301 [Commer Fish Abstr 23(7);1970;25(9.19)].

In this survey of the laws and machinery for dealing with problems of environmental pollution in Canada and the abatement and control of transboundary pollution. Problems arise in relation to the coordination of research activities and investigations, allocation of financial resources, establishment of uniform standards of quality control and means of enforcement; and even though a local program may be satisfactory in a particular jurisdiction there is no assurance that the program will be effective in its contribution to the solution of the international problem. In order to strengthen the joint machinery which has been established to ensure the observance of the international obligations resting on Canada and the United States ~~XXX~~ to prevent injurious transboundary pollution, the author suggest (1) the government could add a clause to the Boundary waters treaty affirming with regard to transboundary air pollution. The two governmen might also, in relation to both obligations, undertake to give domestic effect by enacting the necessary legislation. (2) The governments could vest the International Joint Commission (IJC) (created by the Boundary waters treaty) with jurisdiction over all matters of boun dary water and air pollution which were having transbound ry effects in relation to initiating the investigation wit without awaiting a reference and to coordinatin the various bodies involved in the study. (3) The IJC should be empowered to exercise supervision over the implementati of its study and be authorised to report offenders to the Attorney General of the national government with recommendations for action to be taken. The reporting of violatic procedure to be effective would necessitate the two governments' securing legislation which would give statutory effect to the stan ards for quality control enunciated by the IGC and enable the Attorneys-General to launch proceedings

192. SCHWARTZ (I). CW (Chemical week) report. Environmental control. Chemical Week 106(24);1970;79-102. [Commer Fish Abstr 23(9);1970;34(9.19)].

This paper details how the process industries are trying to meet the challenge of controlling pollution. The chemical and equipment industry is involved to the amount of $ 1 billion per year in protecting the environment, in terms of money spent on in plant control and in sales of chemical products and control tools to others. However, the situation is in constant change as new regulations, technology, and community pressure come to bear.

This report examined the three major areas of environmental improvement--air, water, and the handling of solid wastes. The authors discusses the regulatory situation, the equipment and techniques available to solve pollution problems, and the markets for control products and services. Listed are (1) the Federal Laws that regulate pollution control and (2) the name and address of the pollution control agency in each state.

193. FRYE (J). Gelled oil may limit spill effects. National Fisherman 51(5);1970;24A. [Commer Fish Abstr 23(11);1970;21(9.19)

A new method of treating oil spills promises not only to save the oil but to protect fish and other marine life as well. The idea is to turn the oil into a floating jelly that stays together rather than spreading across the surface of the water in the familiar slick. Such a jelly may drift for days, regardless of storms or temperature changes, having no more effect on marine life than a piece of driftwood has. Eventually it can be picked up mechanically and hauled back to the refinery for reprocessing. The gelling system can be used to treat an entire cargo of either crude or fuel oil; it can be easily pumped into and mixed with the oil aboard ship.

WATER POLLUTION PREVENTION

194. KAARTOTIE (?). Water pollution prevention. Kem Teolisuus 25(11);1968;856-9, 862-76 Ab No.7093r [Chemical Abstract 70;1969;207.
Pollution, its occurrence and causes are discussed in relation to the capability of water bodies to absorb water and to purify. Purification of waste on a small scale and central treatment of plants by mechanical, biological or other means for preventing pollution are discussed also.

PREVENTION OF RIVER WATER POLLUTION

195. Deodorizing saves salmon river. Norwegian fish Maritime News 16(4);1969;21([Commer Fish Abstr 23(7);1970;15(6.132

The Irish Fish meal Company's plant at Mornington (Meath, Ireland) is located on a river used by migrating salmon. For this reason, the river had to be protected from thermal and plant waste pollution and a nearly urban area from air pollution. The equipment installed to avert these types of pollution is described in brief.

No press liquor or blood water flows back into the river. Specially designed internal entrainment separators reduce the carry-over of droplets to a minimum; therefore, condensate is very clean. Two multicoil, series-operating, steam dryers eliminate the odor problem during the drying of whole meal. The exhaust gas from each dryer is discharged at the material inlet end and blown first to the cyclone and then to a gas scrubber. The flow is counter-current to the cooling water, which enters at the top of the dryer. The scrubber contains an entrainment separator and a water-sealed outlet for the cooling waters. From the scrubber, the exhaust air returns to the dryer. The bleed off air is vented to the boiler furnace, where the last traces of malodor are destroyed. Because only small amounts of bleed off air are drawn into the system by the vacuum within the dryers, the operation of the furnace is not disturbed. Within the factory, all machinery possible including unloading equipment and raw material storage bin is tight. Even the sludge from the separators is put back into the processing line.

AIR POLLUTION CONTROL

196. SITTIG (M). Air pollution control processes and equipment. Chem Process Rev No.24;1968;260 [Chem Abstr 70;1969;235 Ab No.40490m].

197. [illegible] ([illegible]) and WILLISON ([illegible]). Waste water recirculation as a means of river pollution abatement. J American Soc of Sugar Beet Technologists 15(5);1969;396-402.

The recirculation system described, used at a sugar refinery, disposes of very large amounts of dissolved organic matter and suspended solids. Pulp press water and lime cake are not discharged but returned to the diffuser and lagooned respectively. A flow diagram illustrates the flume water system consisting of a screening station, clarifier, sludge handling and clarified water supply system. pH of water is raised to >11.5 by milk of lime. Sludge collection beds consist of 2 adjacent areas 1360 x 450 x 2 ft, used in alternate years. Clarified water is used for fluming, washing and rinsing beets. Concentration of dissolved solids in recirculated water reaches a plateau of 10,000 ppm total dissolved solids, 6000 ppm BDO. As this corresponds to the osmotic pressure inside the beets, further sugar extraction is prevented, resulting in a saving of 4760 lb sugar/1000 ton of beets compared with a non recirculating system. No odor problem occurred with sludge beds with food drainage.

INDUSTRIAL POLLUTION CONTROL

198. GRUBB (HP). Responsible management of industrial pollution control. Heating, Piping and Air Conditioning 42(9); 1970;98-100 [Commer Fish Abstr 23(12);1970;33(9.19)].

This article describes how to organize, initiate, and maintain a program for economical control of industrial aeropols and hydropols.

199. HORTON (BS) and others. Membrane separation processes for the abatement of pollution from whey. Intern Dairy Congress 1E;1970;442.

Cheese whey BOD_5 was reduced to <1000 ppm in a 500 lb/h pilot plant using ultrafiltration to concentrate protein to 20% in the 1st stage and reverse osmosis to produce a 20% lactose concentrate in the 2nd stage. Capital and running costs compared favourably with other processes

200. Fish processing pollution control. Food in Canada 30([illegible]);1970;18.

201. MOTOHIRO (T) and TERAUCHI (H). Studies on the prevention of offensive odour from fish processing plants. III. Diffusion of the odorousgas in air and effective height of an exhaust stack. Bull Fac Fish Hokkaido Univ 20(3);1969; 235-241 [Commer Fish Abstr 23(7);1970;7(0.8)].

A study was made to determine the relation between the chemical composition of odorous gases emitted from a fish-processing firm and the intensity of the odor at places [illegible] distances from the firm. The gases were found to consist of ammonia, trimethylamine, hydrogen sulfide, and

indol. Odorous compounds that were emitted in small amou disappeared and the intensity of the others decreased as the distance from the firm increased.

From the data obtained during the study, the authors were able to calculate the regular distribution of a given concentration of odorous gases. They used the following equation: $C = 2.8 \times 10^{-3} F1\ (h/H)/UX0h$ in which C is the concentration of the gases (mg./m^3), h' is the height at which the gases are diffused (m), H is the effective heig of the stack (m), U is the average wind velocity (m/sec), X is the distance downwind of the affected site from the fish processing plant (km) 0 is the angle at which the gases are diffused (deg) and F1 is a gas height factor.

From this equation, the authors determined that, in view of local meteorological conditions, the effective height of the stack under study should be more than 20m.

202. GILLESPIE (GJ). The fisheries battle against pollution. Fisheries of Canada 21(9);1969;3-8.

Causes of water pollution which affect the growth of fish are considered, the most important being, from pulp and paper mills, pesticides and wastes from mining operations The toxic effluents from some industrial areas are of con siderable importance in some districts. The particular region considered is British Columbia.

203. GIBSON (JR), and others. Sources of error in the use of fish br acetylcholine sterase activity as a monitor for pollution Bull Environ Contam Toxicol ^(1);1969;17-23 (Eng) [Chem Abstr 70;1969;148 Ab No. 85791b].

A monitoring method based on a 10% depression in fish bra acetylcholinesterase activity can lead to eroneous conclu sions. The max. difference in mean specific activity of the enzyme for 3 bluegill sunfish (Lepomis macro-chirus) populations was 7%. Within populations, variation was 19, 9, and 15%; max. difference between populations on a given day was 16%, but 19% on different days. A 10% inhibition was found in brains of unthawed fish, brains removed from fish thawed for 2 hrs. at room temperature showed increased variation although insignificant inhibi- tion. Death did not necessarily occur when enzyme levels were decreased 40-70% as was suggested by Weiss (1958, 1959, 1961). Fish that became moribund in 750 ppb parathion showed only a 25% drop. in enzyme activity, while those that became moribund in 20 ppb in enzyme inhi- bition failed to develop pronounced toxic symptoms and recovered completely when removed to fresh water.

204. WEIR (PA) and HINE (CH). Effects of various metals on behaviour of conditioned goldfish, Arch Environ Health 20(1);1970; 45-51 [Commer Fish Abstr 23(4);1970;27(9.19)].

The authors demonstrate the value of using a behavioral method as a means of assessing sublethal toxicity.

Goldfish (Carassius auratus), which are shown as intermediate in most lists of relative sensitivity to toxicity, were conditioned to react to light and/or shock. When the reactions during conditioning trials were correct within 5 percent for 3 consecutive days, the fish were put into toxic exposure tanks, containing sodium arsenate, or lead nitrate, or mercuric chloride, or selenium dioxide. The conditioned avoidance response of the fish were tested All four metal ions impaired performance at concentrations below the lethal concentrations for 1 percent of the fish. Mercury was the most deleterious, producing measurable effects at 0.003 ppm; lead significantly impaired the fish behavior at concentrations of 0.07 ppm; arsenic at 0.1 ppm and selenium at 0.25 ppm.

The authors point out that the effects reported here produced at levels below those currently accepted as safe. They add, as an example, that although lead has not been reported in the tissues of poisoned fishes, the effects reported here were induced at levels approximating those for potable water. Fish could die in such a stream, since their normal feeding behavior would be interrupted.

The authors suggest that the method of conditioned avoidance testing, because of its reliability, could be used to re-evaluate the risks of contaminants. Moreover, the results of such tests would be useful in setting water-quality standards.

205. WILLARD (MJ). ,Infrared peeling: Reduces pollution cuts costs. Food Tech 25(2);1971;27.

Development of an infrared or 'dry' caustic peeling method makes it possible to recover peel waste from fruit and vegetables as a semi solid by product material which is well suited for use in cattle feeding. By removing solids lost in peeling from the processing plant effluent Only the non peeling waste must be treated in normal primary and secondary treatment systems, thus reducing pollution load and waste treatment costs. Commercial process and equipment for potatoes are described, and data on reduction of pollution and costs are presented. Results of pilot plant investigations on sweet potatoes, and laboratory investigations indicate that application of the process to other vegetables and fruits may be possible.

206. BJERRE (P). Reduction of effluent through CIP-system design. Intern Dairy Congress 1E:1970;8.

An in-place cleaning system is described in which costs and water pollution are both minimized by confining contaminated detergent solution within the circulation system and preventing its return to the make up tank.

207. BUSCH (A). Total carbon analysis in water pollution control. Chem Environ Aquatic Habitat Proc IPP(Intern Biol Programme) Symp 1966(Pub 1967) 133-43(Eng). [Chem Abstr 70;1969;235 Ab No. 40499w].

Because of the significance of O as a H acceptor in treatment processes, the use of O equivs. as a measure o total org. content was accepted as the standard procedur The basic objective of all methods proposed for org. pol pollution measurement is the detn. of the biol. degradab org. C. With the advent of the C analyzer it becomes possible to det. low concns. of C in aq. solns. without time consuming anal. work. The sample is vaporized to f steam and the carbonaceous material oxidized to CO_2 whic is measured in an air analyzer the measurement required 2 min. and the precision is ± 2%. The carbonates and dissolved CO_2 in the sample are first removed with Ba. The total org. C detn. can be used to measure the change in org. C brought about by bacterial action by using the B.O.D. bottle or Warburg app. A mass culture procedure is also described. The degree of bio-degradability of carbonaceous material can thus be detd.

208. POTTER (JL). Use pollution to benefit mankind. Ocean Ind. 4(5);1969;94-97.

Possible developments in the utilization of waste materi from industry for the production of proteins, fertiliser animal feed additives, etc., are considered. Yeasts can be Grown on waste organic compounds and the amino acids and vitamins present in the yeasts are listed. Algae have useful applications and these can be grown on sewage. The heat from cooling water can be used for improving the growth of marine organisms, eg. oysters. There are 4 references.

209. Pollution legislation - the warning signs are up. Food in Canad 28(2);1968;36, 51.

The legislation being laid down in each of the provinces in canada to attack the problems of water pollution is considered briefly.

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The bibliography presented here has been compiled from the Indian Science Abstracts, Food Technology Abstracts (CFTRI), Documentation List for Food Technology and Library Bulletin (CFTRI) for the period 1966 to 1970. It gives an idea about Indian literature on Food Technology produced in these years.

The bibliography lists 442 papers; the references are arranged in classified order with Author and Subject index. The bibliography has been compiled by Sri S.V. Sangameswaran, Miss. V.S.Susheelamani. The index has been prepared by Miss. Rachel Eapen.

It is planned to keep a track of all the Indian Literature on Food Technology and to produce similar bibliographies from time to time. The readers and users of this list are requested to kindly send their comments and suggestions to the CFTRI Library.

K.M. DASTUR
Chairman, Library Committee.

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Protein

1. GOSWAMI (KP) and LAHIRI (A). Biosynthesis of protein from coal. FRI News 17(1);1967;8-11 (2971).

2. GOSWAMI (KP) and LAHIRI (A). Hydrocarbons hold promise for microbial synthesis of proteins. Chem Age of India 18(5);1967;345-50 (3894).

3. IYENGAR (MS) and others. Some bio-engineering aspects of production of protein from petroleum hydrocarbons. Chem Age of India 18(3);1968;216-20 (2972).

4. KAWATRA (BL) and others. Studies on guar (cyamopsis tetra gonoloba) protein. J Nutr Dietet 6(2);1969;91.

5. VENKATESAN (N). Studies on seed proteins. 1967, Bombay University (10822).

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10. KRISHNAN (PS) and others. Use of surface active agents in the isolation of enzymes from plant tissues and their assay. J Sc Indus Res 28(5);1969;181.

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12. LEWIS (YS) and others. Studies on some essential oils. Indian Perfumer 11(Pt.1);1967;5.

13. NAMBUDIRI (ES) and others. Production of cardamom oil by distillation. Res & Indus 13(3);1968;140-44.

14. NAGESWARA RAO (C) and NARASINGA RAO (BS). Effect of heating on fat and oils due to cooking. Indian J med Res 56(11);1968;1732-9.

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15. HINDUSTAN LEVER LTD. Foodstuffs. India 106492(Accepted on 6.10.1967) (5085);

16. SENGUPTA (SR) and PAL (B). Studies on less familiar foods. Sci and Cult 34(8);1968;374.

17. SENGUPTA (SR) and PAL (B). Studies on less familiar foods. II. Sci and Cult 34(10);1968;437-9.

18. SENGUPTA (SR) and PAL (B). Studies on less familiar foods. Part III. Sc and Cult 35(3);1969;111.

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Food, Heat processing

22. KANUR (SB) and others. Technique of heat processing of foods in flexible pouches. J Food Sc Tech 5(1);1968;17.(7278).

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23. SARBJIT SINGH. Gas storage. Climate control 1(2);1968;39-42 (8692).

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27. PILLAI (RS). Improvements in or relating to machines for cooling drying, boiling of various kinds of foodstuffs. India 109809 (acc. on 23.8.1968) (10039).

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BIBLIOGRAPHY ON PARBOILING

Compiled by

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CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE,
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F O R E W O R D

Parboiling is an ancient technique used in the processing of paddy to retain the food value in rice. Investigations to improve the traditional method have been constantly carried out in India and elsewhere to produce a better product. Improved and mechanized parboiling processes have been developed by C.F.T.R.I. and Jadhavapur University, West Bengal to ensure more nutritive and better flavoured product. It may be noted that in India alone, more than 57 per cent of the total of rice produced is eaten in the parboiled form.

In the United States a process, similar to that of parboiling was initiated in 1941-42 to produce converted rice and in the recent patented processes, it has been mechanized for a better yield. Parboiling has also been applied to wheat in the Middle Eastern Countries to produce the popularly known Bulgur and to Lathyrus in India to remove the toxic factors from the grain.

The bibliography has been compiled in order to acquire a complete literary survey of the parboiling technique and its applications so that it will be of use as a ready reference to the scientists working in this area. The bibliography is almost exhaustive and cover the period upto 1971. The bibliography has been arranged in a classified sequence with author and subject index.

I am thankful to Dr. M.S. Shetty and Shri S.V. Sangameswaran for compiling this bibliography and to Miss. Eapen for preparing subject and author index.

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CFTRI BIBLIOGRAPHICAL SERIES NUMBER 8

A Select Bibliography on

ALCOHOLIC BEVERAGES
(1965-1971)

1972

NO.8.

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
MYSORE

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CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
MYSORE

The wine industry in India is still in its infancy. However, grape cultivation is increasing, and the only way to use the surplus produce is to convert it into wine or thence obtain brandy. The beer industry is older, some factories having been established by the British during their rule. Distilled beverage industry is also slowly developing in the country. Hitherto, only distillery alcohol obtained from molasses fermentation was being used to produce the so-called Indian made foreign liquors. The use of grape must and grain mash for making brandy or whisky is slowly increasing.

Quality control is very important in alcoholic beverage manufacture. For this, the processor should have knowledge of published literature on the subject. Indian publications are only few in number. A bibliography of recent world literature on alcoholic beverages has, therefore, been prepared and presented here.

The bibliography has been compiled from Food Technology Abstracts, Documentation List for Food Technology and Library Bulletin (CFTRI) for the period 1965-1971. The bibliography lists 493 papers; the references are arranged in classified order with author and subject index. The bibliography has been compiled by Shri V Krishnaswamy Rao and Shri S V Sangameswaran and the classification has been done by Miss Rachel Eapen.

It is planned to keep a track of all the literature on alcoholic beverages and to produce similar bibliographies from time to time. The readers and the users of this list are requested to kindly send their comments and suggestions to CFTRI Library.

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Beer

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392 AULT (RG)
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394 RICHARDS (M)
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403 OTTER (GE) and others
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430 GRAMSHAW (JW)
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No. 9

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
MYSORE-2A, INDIA

PREFACE

Some years ago, the Food and Agriculture Organization of the United Nations brought out a cyclostyled list of institutions dealing with Food Science and Technology, in most of the countries of the world. The list of Indian institutions was found to be somewhat obsolete and very far from complete. A more up-to-date list was compiled at very short notice in the CFTRI Library, and it was included in the second edition of the FAO List in 1966.

Since then, interest in Food Science and Technology has spread to a much wider circle. For example, new departments of Food Technology have been opened in many of the Agricultural Universities; and many more colleges of Home Science are offering master's degree courses in Food and Nutrition. Organizations whose work was previously confined to agriculture and horticulture have begun to evince an interest in the post-harvest handling and processing of their products, while associations of food industries are thinking of sponsoring research in this subject.

The time, therefore, appeared opportune to bring out a comprehensive list of all Indian organizations interested in this field with the exception, however, of individual food manufacturing firms. The Directory of Scientific Research Institutions in India, published by INSDOC in 1969, was the main sources of information.

This list which was compiled by Shri S.B. Chennakashava Das, Asst. Librarian, contains nearly 300 entries, of which 236 are teaching or research institutions, and their field stations. The remaining entries are of associations, boards, corporations, councils and societies which could function as sponsors of research. The entries, consisting of the names and addresses of the institutions or organizations, are arranged subject-wise in alphabetical order, and a subject index is also provided.

It is hoped that the list will prove useful in establishing contacts between food scientists and technologists, as well as in the planning and coordination of research projects.

K.M. Dastur
Chairman,
Library Committee.

Indian Institutions in the field of Food Technology and related Sciences.
(A Classified list)

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   Division of Biochemistry and Food Technology,
   Trombay
   Bombay-74 (Maharashtra)

2. CENTRAL FOOD LABORATORY,
   3, Kyd Street, Calcutta-16 (West Bengal)

3. CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE,
   Mysore-570013

i CFTRI EXPERIMENT STATION
Bhawan's College Campus, Andheri, Bombay-58(AS)
(Maharashtra)

ii CFTRI EXPERIMENT STATION
C-25, Industrial Estate, Sanatnagar, Hyderabad-18
(Andhra Pradesh)

iii CFTRI EXPERIMENT STATION
Pilot plant Building of CDRI, Opposite High Court,
Lucknow-1 (Uttar Pradesh)

iv CFTRI EXPERIMENT STATION
Gill Road, Ludhiana-3 (Punjab)

v CFTRI EXPERIMENT STATION
Gole Bungalow, Nelson Square, Nagpur-1 (Maharashtra)

vi CFTRI FISH TECHNOLOGY EXPERIMENT STATION
Hoige Bazaar, Mangalore (Mysore)

vii CFTRI EXPERIMENT STATION
Krishnadas Nivas, Shoranur Road, Trichur-1 (Kerala)

4. DEFENCE FOOD RESEARCH LABORATORY
   Jyothinagar, Mysore-570010 (Mysore)

5. FOOD CRAFT INSTITUTE
   Government Polytechnic Compound, Ambawadi, Ahmedabad-15
   (Gujarat)

6. FOOD CRAFT INSTITUTE
   S.J. Polytechnic Buildings, Seshadri Road, Bangalore-1
   (Mysore)

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7. FOOD CRAFT INSTITUTE
CTI Campus, Vidyanagar, Hyderabad (Andhra Pradesh)

8. FOOD CRAFT INSTITUTE
Kalamassery, Alwaye-4 (Kerala)

9. FOOD CRAFT INSTITUTE
18B, Outram Road, Lucknow (Uttar Pradesh)

0. FOOD CRAFT INSTITUTE
Government Polytechnic Campus, Nagpur (Maharashtra)

1. FOOD CRAFT INSTITUTE
Alto Porvorin P.O., Betaim Bardez, Panjim (Goa)

2. GOVERNMENT ANALYSTS' LABORATORY
Division of Administration of the prevention of food adulteration act, Food analysis, teaching public health chemistry and food sanitation, Red Cross Road, Trivandrum (Kerala)

3 GOVERNMENT HORTICULTURAL RESEARCH INSTITUTE
Saharanpur (Uttar Pradesh)

4 HARCOURT BUTLER TECHNOLOGICAL INSTITUTE
Division of Chemical Engineering and Chemical technology (in food) Nawabganj, Kanpur-2 (Uttar Pradesh)

4a BOMBAY UNIVERSITY
Division of Food Technology, Oils, Fats, and Waxes, Matunga Road, Bombay-19 (Maharashtra)

5 HINDUSTAN LEVER RESEARCH CENTRE
Division of Food, Oils and Fats, I.C.T. Link Road, Chakala, Andheri East, Bombay-69 (Maharashtra)

6 INDIAN AGRICULTURAL RESEARCH INSTITUTE
Pusa, IARI P.O., New Delhi-12

17 INDIAN INSTITUTE OF HORTICULTURAL RESEARCH
No.255, Upper Palace Orchard, Bangalore-6 (Mysore)

18 INDUSTRIAL TESTING AND RESEARCH LABORATORY
Division of Food Technology, Trivandrum-19 (Kerala)

19 INSTITUTE OF AGRICULTURE
Anand P.O., Kaira District (Gujarat)

20 INSTITUTE OF SCIENCE
(Biochemistry Division - Nutrition, Food Preservation and enzymes) 15 Mme Cama Road, Fort, Bombay-32(Maharashtra)

21 JADAVPUR UNIVERSITY
Faculty of Engineering, Division of Chemical Engineering, Food Technology, Jadavpur University P.O. Calcutta-32(WB)

1a REGIONAL RESEARCH LABORATORY
(Division of Food Technology), Canal Road, Jammu

Presearvation

22 DEMONSTRATION-CUM-COMMUNITY CANNING AND FOOD PRESERVATION CENTRE
- a) Bombay (Maharashtra)
- b) Calcutta (West Bengal)
- c) Delhi
- d) Madras (Tamil Nadu)

Canning

23 COMMUNITY CANNING CENTRE (USAID COLLABORATION)
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- e) Gauhati (Assam)
- f) Hyderabad (Andhra Pradesh)
- g) Poona (Maharashtra)
- h) Simla (Himachal Pradesh)
- i) Srinagar (Jammu and Kashmir)

Storage

24 GRAIN STORAGE RESEARCH AND TRAINING CENTRE
Meerut Road, P.O.Box No.10, Hapur (Uttar Pradesh)

Rice

25 CENTRAL RICE RESEARCH INSTITUTE
Cuttak-6 (Orissa)

26 CENTRAL RICE RESEZRCH STATION
Pattambi P.O., Kerala

27 CENTRAL SALINE RICE RESEARCH STATION
Central Rice Research Institute, Canning Town P.O., 24-Paraganas, West Bengal

28 INDIAN INSTITUTE OF TECHNOLOGY
Division of Rice Technology and Processing, Kharagpur (West Bengal)

29 REGIONAL RICE RESEARCH STATION
Kayamkulam (Kerala)

30 REGIONAL RICE RESEARCH STATION
Mannuthy, Trichur District (Kerala)

31 REGIONAL RICE RESEARCH STATION
Moncompu P.O., Allepey District (Kerala)

C..

2. REGIONAL RICE RESEARCH STATION
Raha P.O., Nowgong District (Assam)

3 RICE RESEARCH STATION
Ambasamudram, Tirunelveli District (Tamil Nadu)

4 RICE RESEARCH STATION
Chinsurah P.O., Hooghly District (West Bengal)

5 RICE RESEARCH STATION
Jeypore P.O., Koraput District (Orissa)

6 RICE RESEARCH STATION,
Tirukuppam, Tirur P.O., Chingalput District (Tamil Nadu)

Wheat

7 WHEAT RESEARCH SCHEME
P-12/76, Kalyani Town, Kalyani P.O., Nadia District (W.B.)

Millet

38 MILLET RESEARCH STATION
Andhra Pradesh Agricultural University
Peddapuram P.O., East Godavari District (Andhra Pradesh)

39 MILLET RESEARCH STATION
Andhra Pradesh Agricultural University, Podalakur P.O.,
Nellore District (Andhra Pradesh)

40 MILLET RESEARCH STATION
Andhra Pradesh Agricultural University, Kottagraharam,
Vizianagaram-1, Vishakapatnam District (Andhra Pradesh)

Bajra (Pearl Millet)

41 BAJRA RESEARCH SUB-STATION
Vijapur, Aurangabad District (Maharashtra)

Maize

42 MAIZE RESEARCH STATION
Amberpet, Hyderabad-13 (Andhra Pradesh)

Pulse

43 PULSES RESEARCH SUB-STATION
Jayamkondacholapuram, Tiruchi District (Tamil Nadu)

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Oil and Oil seeds

44 ALAGAPPA CHETTIAR COLLEGE OF TECHNOLOGY
Division of Oil, Guindy, Madras-25 (Tamil Nadu)

45 BANARAS HINDU UNIVERSITY
Department of Chemical Engineering and Chemical Technology (Oils), Varanasi-5 (Uttar Pradesh).

46 CENTRAL RESEARCH INSTITUTE FOR VILLAGE INDUSTRIES
(Field of research Oils), Khadi and Village Industries Commission, Maganwadi, Wardha (Maharashtra)

47 DELHI UNIVERSITY
Department of Chemistry (Oils), Delhi-7

48 FERGUSON COLLEGE
Department of Chemistry (Oils), Poona, Maharashtra

49 INDIAN INSTITUTE OF SCIENCE
Department of Biochemistry (Fats and Oils), Bangalore-12

50 JAMNALAL BAJAJ CENTRAL RESEARCH INSTITUTE FOR VILLAGE INDUSTRIES
Division of Oil and Soap, Maganwadi P.O. Box 4, Wardha (Maharashtra).

51 JIVAJI INDUSTRIAL RESEARCH LABORATORY
Division of Oils, Gwalior (Madhya Pradesh).

52 LAXMINARAYAN INSTITUTE OF TECHNOLOGY
Division of Oils, Amaravathi Road, Nagpur-1 (Maharashtra)

53 OILSEEDS RESEARCH STATION
Banaras (Uttar Pradesh)

54 OILSEEDS RESEARCH STATION
Belatas (Uttar Pradesh)

55 OILSEEDS RESEARCH STATION
Haripura, Chamba District (Himachal Pradesh)

56 OILSEEDS RESEARCH STATION
Kadiri, Ananthapur District (Andhra Pradesh)

57 OILSEEDS RESEARCH STATION
Ludhiana (Punjab)

58 OILSEEDS RESEARCH STATION
Manund, Mehsana District (Gujarat)

59 OILSEEDS RESEARCH STATION
Mauranipur, Uttar Pradesh

60 OILSEEDS RESEARCH STATION
Mavelikara, Alleppey District (Kerala)

61 OILSEEDS RESEARCH SUB-STATION
Gurgaon (Punjab).

62 OILSEEDS RESEARCH SUB-STATION
Kangra (Punjab).

63 OILSEEDS RESEARCH SUB-STATION
Kapurthala (Punjab)

64 OILSEEDS RESEARCH SUB-STATION
Samrala, Ludhiana District (Punjab)

65 OIL TECHNOLOGICAL RESEARCH INSTITUTE
Anantapur (Andhra Pradesh)

66 OSMANIA UNIVERSITY
Department of Chemical Technology (Oils), Hyderabad-7
(Andhra Pradesh)

67 PROVENTIAL INDUSTRIAL RESEARCH LABORATORY
Division of Oils, Patna-5 (Bihar).

68 REGIONAL RESEARCH CENTRE
Oilseeds and Millets (ICAR), Kanpur (Uttar Pradesh)

69 REGIONAL RESEARCH LABORATORY
Division of Oils and Fats, Hyderabad-9 (Andhra Pradesh)

70 REGIONAL RESEARCH LABORATORY
Division of Oils, Gauhathi, Kamrup District (Assam)

71 SRIRAM INSTITUTE FOR INDUSTRIAL RESEARCH
Division of Oils, 19, University Road, Delhi-7

72 UNIVERSITY COLLEGE
Department of Chemistry (Oils) Punjab University,
Hoshiarpur, Punjab.

73 UNIVERSITY COLLEGE OF SCIENCE AND TECHNOLOGY
Department of Applied chemistry (Oils), 92, Acharya
Prafullachandra Road, Calcutta (West Bengal)

74 UNIVERSITY OF KERALA
Department of Applied Chemistry (Oils), Trivandrum, Kerala

Coconut

75 CENTRAL COCONUT RESEARCH STATION
Kasaragod, Kudlu P.O. (Kerala).

76 CENTRAL COCONUT RESEARCH STATION
Kayangulam, Ochira P.O. (Kerala)

77 CENTRAL COCONUT RESEARCH STATION
Nileswar, Cannanore District (Kerala)

78 REGIONAL COCONUT RESEARCH STATION
University of Agricultural Sciences, Arasikere (Mysore)

79 REGIONAL COCONUT RESEARCH STATION
Kahikuchi, Azara P.O., Kamrup District (Assam)

80 REGIONAL COCONUT RESEARCH STATION
Kattachalkuzhy P.O., Via Balaramapuram, Neyyattinkara (Kerala)

81 REGIONAL COCONUT RESEARCH STATION
Kumarakom (Kerala)

82 REGIONAL COCONUT RESEARCH STATION
Veppankulam, Thanjavur District (Tamil Nadu)

Arecanut

83 CENTRAL ARECANUT RESEARCH STATION
Vittal P.O. (Mysore)

84 REGIONAL ARECANUT RESEARCH STATION
Hire halli P.O. (Mysore)

85 REGIONAL ARECANUT RESEARCH STATION
Kahikuchi (Assam)

86 REGIONAL ARECANUT RESEARCH STATION
Kannara P.O., Trichur District (Kerala)

87 REGIONAL ARECANUT RESEARCH STATION
Mohitnagar (West Bengal)

88 REGIONAL ARECANUT RESEARCH STATION
Palode (Kerala)

Groundnut

89 GROUNDNUT RESEARCH STATION
Mainpuri (Uttar Pradesh)

90 GROUNDNUT RESEARCH STATION
Masulipatnam, Krishna District (Andhra Pradesh)

91 GROUNDNUT RESEARCH STATION
Pollachi, Coimbatore District (Tamil Nadu)

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Cashew

CASHEW RESEARCH STATION
Anakkayam, Via Malappuram (Kerala)

CASHEW RESEARCH STATION
Andhra Pradesh Agricultural University, Bapatla,
Guntur District (Andhra Pradesh)

CASHEW RESEARCH STATION
Kuppnatham P.O., Vridhachalam, South Arcot District
(Tamil Nadu)

CENTRAL CASHEWNUT RESEARCH STATION
University of Agricultural Sciences, Ullal P.O., South
Kanara District (Mysore).

REGIONAL CASHEWNUT RESEARCH STATION
Vengurla, Rathnagiri District (Maharashtra)

Potato

CENTRAL POTATO RESEARCH INSTITUTE
Simla-1 (Himachal Pradesh)

CENTRAL POTATO RESEARCH STATION
Mukteswar (Uttar Pradesh)

CENTRAL POTATO RESEARCH STATION
Patna (Bihar)

POTATO GOLDEN NEMATODE SCHEME
Arni House, Ootacamund-2, Nilgiris (Tamil Nadu)

Fruit

FRUIT RESEARCH FARM
J.N. Krishi Vishwa Vidyalaya, Entkhedi, Bhopal (M.P.)

FRUIT RESEARCH STATION
Basti (Uttar Pradesh)

FRUIT RESEARCH STATION
Chianki P.O., Palamau, Bihar.

FRUIT RESEARCH STATION
Periyakulam, Madhurai District (Tamil Nadu)

GOVERNMENT FRUIT RESEARCH STATION
Cape Comorin (Tamil Nadu)

GOVERNMENT HILL FRUIT RESEARCH STATION
Chaubattia, P.O., Ranikhet, Almore District (Uttar Pradesh)

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107 POMOLOGICAL STATION
Coonoor, Nilgiris District (Tamil Nadu)

108 REGIONAL FRUIT RESEARCH STATION
Andhra Pradesh Agricultural University, Anantharajupet P.O., Cuddappa District (Andhra Pradesh)

109 REGIONAL FRUIT RESEARCH STATION
Chettalli, Coorg District (Mysore)

110 REGIONAL FRUIT RESEARCH STATION
Mashobra, Simla-7 (Himachal Pradesh).

Citrus

111 GOVERNMENT CITRUS FRUIT RESEARCH STATION
Burnihat (via) K and J District (Assam)

Banana

112 BANANA RESEARCH STATION
Hajipur P.O. (Muzaffarpur) Bihar

113 BANANA RESEARCH STATION
Kovvur P.O., West Godavari District (Andhra Pradesh)

114 BANANA AND PINEAPPLE RESEARCH STATION
Kannara P.O., Trichur District (Kerala)

115 CENTRAL BANANA RESEARCH STATION
Aduthurai P.O., Thanjore District (Tamil Nadu)

Sugar

116 NATIONAL SUGAR INSTITUTE
Kalianpur, Kanpur (Uttar Pradesh)

Starch

117 ANIL STARCH PRODUCTS LIMITED
Anil Road P.O., Box 1062, Ahmedabad (Gujarat)

Dairy

118 COMPOSITE LIVESTOCK FARM AND RESEARCH STATION
Dairy Division, Hessaraghatta, Bangalore North (Mysore)

119 DAIRY SCIENCE COLLEGE
Anand (Gujarat)

120 DAIRY SCIENCE COLLEGE
Karnal (Punjab)

121 GUJARAT COLLEGE OF VETERINARY SCIENCE AND ANIMAL HUSBANDRY
Division of Dairy Science, Near Jaganath Mahadev,
Anand (Gujarat)

122 INDIAN VETERINARY RESEARCH INSTITUTE
Izathnagar (Uttar Pradesh)

123 NATIONAL DAIRY RESEARCH INSTITUTE
Karnal (Haryana)

124 NATIONAL DAIRY RESEARCH INSTITUTE
Southern Regional Station, Adugodi P.O., Hosur Road,
Bangalore-30 (Mysore)

125 NATIONAL DAIRY RESEARCH INSTITUTE
Western Regional Station, Aarey Milk Colony, Bombay-65
(Maharashtra)

126 NATIONAL DAIRY RESEARCH INSTITUTE
Eastern Regional Station, Kalyani (West Bengal)

127 STATE INSTITUTE OF ANIMAL HUSBANDRY AND DAIRYING
Haringhata, Mohanpur P.O., Nadia District (West Bengal)

Poultry

128 POULTRY RESEARCH STATION
Andhra Pradesh Agricultural University, Kakinada Port,
East Godawari District (Andhra Pradesh)

Fish

129 ANDHRA UNIVERSITY
Department of Zoology, Fisheries Division, Waltair
(Andhra Pradesh)

130 ANNAMALAI UNIVERSITY
Department of Zoology, Fisheries Division, Annamalai-
nagar, South Arcot District (Tamil Nadu)

131 BANARAS HINDU UNIVERSITY
Department of Zoology, Division of Fish and Fisheries,
Varanasi-5 (Uttar Pradesh)

132 CENTRAL FISHERIES TECHNOLOGICAL RESEARCH STATION
Cochin (Kerala)

133 CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
Barrakpore P.O. (West Bengal)

134 CENTRAL INSTITUTE OF FISHERIES EDUCATION
P.O.Box 7392, Kakori Camp, J.P.Road, Versova, Bombay-58

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135 CENTRAL INSTITUTE OF FISHERIES OPERATIVES
Ernakulam (Kerala)

136 CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
Chittor Road, Ernakulam, Cochin-11 (Kerala)

137 CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
Marine Fisheries P.O., Mandapam Camp (Tamil Nadu)

138 COLLEGE OF FISHERIES SCIENCE
Mangalore (Mysore)

139 DEEP-SEA FISHING STATION
Bombay (Maharashtra)

140 FISHERIES RESEARCH STATION
Pandit Nehru Marg, Jamnagar-1 (Gujarat)

141 FISHERIES TECHNOLOGICAL STATION
West Hill, Kozhikode-5 (Kerala)

142 FISHERIES TECHNOLOGICAL STATION
North Beach Road, Tuticorin-1 (Tamil Nadu)

143 FISHERIES TRAINING INSTITUTE
Bombay (Maharastra)

144 FRESHWATER FISHERIES RESEARCH STATION
Kalyani, West Bengal

145 GAUHATI UNIVERSITY
Department of Zoology, Division of Ichyology
Gauhati University P.O., Gauhati-14 (Assam)

146 HILL-STREAM FISHERIES RESEARCH STATION
Kalimpang, West Bengal

147 INLAND FISHERIES RESEARCH STATION
Bangalore (Mysore)

148 KARNATAK UNIVERSITY
Department of Zoology, Division of Fisheries,
Dharwar-3 (Mysore)

149 MARATHWADA UNIVERSITY
Department of Zoology, Division of Fishery Science,
Aurangabad (Maharashtra)

150 MARINE BIOLOGY LABORATORY AND AQUARIUM
Department of Marine Biology and Oceanography, Division of Fisheries Technology and Ichthyology, University of Kerala, Aquarium, Trivandrum-7 (Kerala)

151 MARINE PRODUCTS PROCESSING TRAINING CENTRE
Mangalore (Mysore)

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152 NAGAPUR UNIVERSITY
Post-Graduate Teaching, Department of Zoology, Division of Ichthyology, Amaravati Road, Nagapur (Maharashtra)

153 PUNJAB UNIVERSITY
Department of Zoology, Division of Fish and Fisheries, Sector 14, Chandigarh.

154 REGIONAL RESEARCH LABORATORY
Division of Fish Protein and related products, Bhuvaneswara-4 (Orissa)

155 REGIONAL TRAINING CENTRE FOR INLAND FISHER OPERATIONS
Agra (Uttar Pradesh)

156 REGIONAL TRAINING CENTRE FOR INLAND FISHERY OPERATIONS
Hyderabad (Andhra Pradesh)

157 SCHOOL OF STUDIES IN ZOOLOGY
Division of Fish, Vikram University, Kothi Road, Ujjain (Madhya Pradesh)

158 UNIVERSITY OF CALICUT
Department of Fisheries, University P.O., Calicut (Kerala)

159 UNIVERSITY OF RAJASTHAN
Department of Zoology, Division of Fishery Biology, Jaipur-4 (Rajasthan)

Tea

160 TEA RESEARCH ASSOCIATION
Tocklai Experimental Station, Jorhat-8 (Assam)

161 UPASI TEA CLONAL CENTRE
Coonoor, Nilgiris (Tamil Nadu)

162 UPASI TEA RESEARCH STATION
Cinchona P.O., Coimbatore District (Tamil Nadu)

163 UPASI TEA RESEARCH SUB-STATION
Vandiperiyar P.O. (Kerala)

Coffee

164 CENTRAL COFFEE RESEARCH INSTITUTE
Coffee Board, Research Department, Coffee Research Station P.O., Chickamagalore District (Mysore)

Toddy (Neera)

165 CENTRAL RESEARCH CUM TRAINING CENTRE
Field of Research (Neera) Dahanu (Maharashtra)

Spice

166 REGIONAL SPICES RESEARCH STATION
Appangala (Mysore)

Sesamum (Gingelly, Niger, Caster, Toria)

167 SESAMUM RESEARCH STATION
Karimnagar, Andhra Pradesh.

168 SESAMUM RESEARCH STATION
Yellamanchili, Vishakapatnam District, Andhra Pradesh.

169 GINGELLY RESEARCH STATION
30, South Agraharam, Karur, Tiruchirapalli District (Tamil Nadu)

170 NIGER RESEARCH STATION
Hosur, Salem District (Tamil Nadu)

171 CASTER RESEARCH STATION
Sanyasigundu Road, Kichipalyam, Salem-1 (Tamil Nadu)

172 TORIA RESEARCH STATION
Rudrapur (Uttar Pradesh)

Pepper

173 MINOR RESEARCH STATION-PEPPER
University of Agricultural Sciences, Sirsi, North Kanara District (Mysore)

174 PEPPER RESEARCH STATION
Taliparamba, Cannanore District (Kerala)

Chillies

175 REGIONAL RESEARCH STATION
Co-ordinated Chillies Scheme, Kovilpatti, Tirunalveli District (Tamil Nadu)

Cardamom

176 CARDAMOM RESEARCH STATION
Pampadumpara P.O., via Vandanmettu, Kottayam District (Kerala)

Entomology

177 ANNAMALAI UNIVERSITY
Department of Zoology, Entomology division, Annamalai-nagar, South Arcot District (Tamil Nadu)

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178 BANARAS HINDU UNIVERSITY
Department of Zoology, Division of Entomology, Varanasi-5 (Uttar Pradesh)

179 GAUHATI UNIVERSITY
Department of Zoology, Division of Entomology, Gauhati University P.O., Gauhati-14 (Assam)

180 KARNATAK UNIVERSITY
Department of Zoology, Division of Entomology, Dharwar-3 (Mysore)

181 NAGPUR UNIVERSITY
Post-Graduate Teaching, Department of Zoology, Division of Entomology, Amaravathi Road, Nagpur, Maharashtra.

182 PUNJAB UNIVERSITY
Department of Zoology, Division of Entomology, Sector-14 Chandigarh

Bee

183 CENTRAL BEE RESEARCH AND TRAINING INSTITUTE
839/1, Shivajinagar, Poona-5 (Maharashtra)

Nutrition

184 ALL INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH
Division of Biochemistry and Nutrition, 110, Chittaranjan Avenue, Calcutta (West Bengal)

185 BENGAL IMMUNITY RESEARCH INSTITUTE
Division of Biochemistry and Nutrition, 39, Acharyya Jagadish Bose Road, Calcutta-17 (West Bengal)

186 HAFFKINE INSTITUTE
Biochemistry and Nutrition Division, Acharya Donde Marg, Parel, Bombay-12 (Maharashtra)

187 LUCKNOW UNIVERSITY
Department of Biochemistry (Nutrition), Lucknow (U.P.)

188 NATIONAL INSTITUTE OF NUTRITION
Tarnaka, Hyderabad-7 (Andhra Pradesh)

189 PUBLIC HEALTH INSTITUTE
Division of Nutrition and Biochemistry, Patna-4(Bihar)

190 PUBLIC HEALTH LABORATORY
Nutrition Division, Red Cross Road, Trivandrum-1 (Kerala)

191 RAPTAKOS BRETT AND COMPANY PRIVATE LIMITED
Research and Control Division (Nutrition), 47,Dr.Annie Besant Road, Worli, Bombay-18 (Maharashtra)

192 WILSON COLLEGE
Department of Biochemistry (Egg proteins, Protein mal-nutrition), Bombay-7 (Maharashtra)

Packaging

193 INDIAN INSTITUTE OF PACKAGING
254-C, Dr.Annie Besant Road, Prabhadevi, Bombay-25 (Maharashtra)

194 INDIAN INSTITUTE OF PACKAGING
51, Sir Thyagaraya Road, Madras-17 (Tamil Nadu)

195 METAL BOX COMPANY OF INDIA LIMITED
Research Department, 92/1, Alipore Road, Calcutta-27 (West Bengal)

196 METAL BOX OF INDIA LIMITED
Tower Yard, Tower Road, Fort, Cochin (Kerala)

197 METAL BOX COMPANY OF INDIA
249, Worli Road, Bombay-18WB, Maharashtra

198 METAL BOX COMPANY OF INDIA LIMITED
Link House, Mathura Road, New Delhi-1

199 METAL BOX COMPANY OF INDIA LIMITED
Elaiya Mudali Street, Thondiarpet, Madras-21 (Tamil Nadu)

Home Science

200 CENTRAL INSTITUTE OF HOME SCIENCE
Bangalore University, Bangalore (Mysore)

201 COLLEGE OF HOME SCIENCE (Bombay and Poona)
S.N.D.T. Women's University, 1, Nathibai Thackersey Road, Maharshi Karve Road, Bombay-2A (Maharashtra)

202 COLLEGE OF HOME SCIENCE
University of Bombay, Nirmala Niketan, 38, New Marine Lines, Bombay-20 (Maharashtra)

203 COLLEGE OF HOME SCIENCE
Andhra Pradesh Agricultural University, Hyderabad-4(A.P.)

204 COLLEGE OF HOME SCIENCE
Punjab Agricultural University, Ludhiana, Punjab.

205 COLLEGE OF HOME SCIENCE
University of Udaipur, Udaipur (Rajasthan)

206 LADY IRWIN COLLEGE
Delhi University, Department of Foods and Nutrition, Sikandra Road, New Delhi.

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207 M.H. COLLEGE OF HOME SCIENCE FOR WOMEN
Division of Foods and Nutrition, University of Jabalpur, Jabalpur (Madhya Pradesh)

208 MAHARAJA SAYYAJIRAO UNIVERSITY OF BARODA
Faculty of Home Science, Department of Foods and Nutrition, Baroda (Gujarat)

209 QUEEN MARY'S COLLEGE
Department of Home Science, Madras University, Madras.(TN)

210 SIET WOMEN'S COLLEGE
Department of Home Science, Madras University, Madras.(T.N)

211 SRI AVINASHILINGAM HOME SCIENCE COLLEGE
Department of Foods and Nutrition, Coimbatore-11 (T.N.)

212 SRI PADMAVATHY COLLEGE FOR WOMEN
Department of Home Science, Sri Venkateshwara University, Thirupathi (Andhra Pradesh)

213 ST. THERESA COLLEGE
Department of Home Science, Kerala University, Ernakulam Cochin (Kerala)

214 UNIVERSITY OF ALLAHABAD
Department of Home Science, Allahabad (Uttar Pradesh)

215 UNIVERSITY OF KERALA
Department of Home Science, Trivandrum (Kerala)

216 UNIVERSITY OF MYSORE
Department of Home Science, Division of Foods and Nutrition, Manasa Gangothri, Mysore-570006 (Mysore)

217 WOMEN'S CHRISTIAN COLLEGE
Department of Home Science, Foods and Nutrition Division, Madras University, Nungambakkam, Madras (Tamil Nadu)

Hotel Science

218 INSTITUTE OF CATERING TECHNOLOGY AND APPLIED NUTRITION
Ministry of Food and Agriculture, Sawarkar Marg, Bombay-28 (Maharashtra)

219 INSTITUTE OF CATERING TECHNOLOGY AND APPLIED NUTRITION
21, Convent Road, Calcutta-14 (West Bengal)

220 INSTITUTE OF CATERING TECHNOLOGY AND APPLIED NUTRITION
Adyar, Madras-20 (Tamil Nadu)

221 INSTITUTE OF HOTEL MANAGEMENT, CATERING AND NUTRITION
Pusa Institute, New Delhi-12.

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Food Technology, Education
(Agricultural University)

222 ANDHRA PRADESH AGRICULTURAL UNIVERSITY
Dilkusha, Hyderabad, Andhra Pradesh.

223 ASSAM AGRICULTURAL UNIVERSITY
Jorhat-4 (Assam)

224 HARYANA AGRICULTURAL UNIVERSITY
Hissar (Haryana)

225 JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA
Jabbalpur (Madhya Pradesh)

226 KERALA AGRICULTURAL UNIVERSITY
Mannuthy, Trichur District (Kerala)

227 MAHATMA PHULE KRISHI VIDYAPEETH
Rahauri, Ahmednagar District (Maharashtra)

228 ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
Bhubaneswar (Orissa)

229 PUNJAB AGRICULTURAL UNIVERSITY
Ludhiana (Punjab)

230 PUNJABRAO KRISHI VIDYAPEETH
Krishi Nagar, Akola (Maharashtra)

231 RAJENDRA AGRICULTURAL UNIVERSITY
Patna (Bihar)

232 TAMILNADU AGRICULTURAL UNIVERSITY
Coimbatore-3 (Tamil Nadu)

233 UNIVERSITY OF AGRICULTURAL SCIENCES
Bangalore-24 (Mysore)

234 UNIVERSITY OF KALYANI
P.O.Kalyani, Nadia District (West Bengal)

235 UNIVERSITY OF UDAIPUR
Udaipur (Rajasthan)

236 UTTAR PRADESH AGRICULTURAL UNIVERSITY
Pantnagar, Nainital District (Uttar Pradesh)

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ASSOCIATIONS

Chemical Sciences

1 TECHNOLOGICAL ASSOCIATION
Department of Chemical Technology, Matunga Road,
Bombay-19 (Maharashtra)

Chemical Engineering

2 CHEMICAL ENGINEERING ASSOCIATION
Indian Institute of Science, Bangalore-12 (Mysore)

3 INDIAN INSTITUTE OF CHEMICAL ENGINEERS
Jadhavpur University Campus, Calcutta-32 (West Bengal)

Food Technology

4 ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (India)
Mysore-570013 (Mysore)

5 ASSOCIATION OF PLANTERS OF TAMIL NADU
"CANOWIE", Coonoor, Nilgiri District (Tamil Nadu)

6 SOUTH INDIA HORTICULTURAL ASSOCIATION
Lawley Road, Coimbatore (Tamil Nadu)

7 UNITED PLANTERS ASSOCIATION OF SOUTHERN INDIA
P.O.Box No.11, "Glenview", Coonoor, Nilgiri District.
(Tamil Nadu)

Milling

8 ROLLER FLOUR MILLERS' FEDERATION OF INDIA
438, Mathura Road, Jangpura, New Delhi-14

Preservation

9 ALL INDIA FOOD PRESERVERS' ASSOCIATION
Hindusthan Lever House, Backbay Reclamation,
Bombay-1 (Maharashtra)

Storage

10 WEST BENGAL COLD STORAGE ASSOCIATION
795, Mahatma Gandhi Road, Calcutta-7 (West Bengal)

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Protein

11 PROTEIN FOODS ASSOCIATION OF INDIA
Mahalakshmi Chambers, 22, Bhulabhai Desai Road,
Bombay-26 (Maharashtra)

Cereal

12 FOODGRAIN TECHNOLOGISTS' RESEARCH ASSOCIATION OF INDIA
P.O.Box No.10, Meerut Road, Hapur (Uttar Pradesh)

Rice

13 ASSOCIATION OF RICE RESEARCH WORKERS (Cuttack)

Cottenseed, Crushing

14 ALL INDIA COTTONSEED CRUSHERS ASSOCIATION
198, J.Tata Road, Bombay-20 (Maharashtra)

Oil and Oilseed

15 ALLEPPEY OIL MILLERS' AND MERCHANTS' ASSOCIATION
Naga Mahal Buildings, Alleppey (Kerala)

16 ANDHRA PRADESH OIL MILLERS ASSOCIATION
Kishanganj, Hyderabad (Andhra Pradesh)

17 BOMBAY OILSEED CRUSHERS' ASSOCIATION
Anna Bhavan, Broach Street, Bombay-9 (Maharashtra)

18 EAST INDIA OIL MILLERS' ASSOCIATION
State Bank Building (Burrabazar Branch), 195, Mahatma
Gandhi Road, Calcutta-7 (West Bengal)

19 OIL TECHNOLOGISTS ASSOCIATION OF INDIA
Nawabganj, Kanpur (Uttar Pradesh)

20 TRAVANCORE OIL MILLERS' ASSOCIATION
Naga Mahal, Alleppey (Kerala)

Sugar

21 SUGAR TECHNOLOGISTS' ASSOCIATION OF INDIA
P.O. Kalyanpur, Kanpur (Uttar Pradesh)

Dairy

22 INDIAN DAIRY SCIENCE ASSOCIATION
E-6, South Extension, Part II, New Delhi-49

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Seafood, Canning

23 SEAFOOD CANNERS' AND FREEZERS' ASSOCIATION OF INDIA
Cochin Company Buildings, XIX/5, Kochangadi, Cochin-5
(Kerala)

Fish

24 MARINE BIOLOGICAL ASSOCIATION
Mandapam Camp, Tamil Nadu.

Tea

25 INDIAN TEA PLANTERS' ASSOCIATION
Post Box No.74, Jalapaiguri (West Bengal)

Tea, Packing

26 TEA PACKETERS ASSOCIATION OF INDIA
P-32/33, India Exchange Place, Calcutta (West Bengal)

Microbiology

27 ASSOCIATION OF MICROBIOLOGISTS OF INDIA
P-27, Princep Street, Calcutta-13 (West Bengal)

Bee

28 ALL INDIA BEE-KEEPERS' ASSOCIATION
424/13, Shaniwar Peth, Poona-2 (Maharashtra)

Home Science

29 ALL INDIA HOME SCIENCE ASSOCIATION OF INDIA
Viharilal College of Home Science, Calcutta (West Bengal)

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BOARDS

Food Technology

1 FOOD AND NUTRITION BOARD
Ministry of Food and Agriculture, Krishi Bhavan,
New Delhi.

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Dairy

2 NATIONAL DAIRY DEVELOPMENT BOARD
Anand (Gujarath)

Fish

3 CENTRAL BOARD OF FISHERIES
New Delhi

Tea

4 TEA BOARD
27 & 29, Brabourne Road, Calcutta-1(West Bengal)

Coffee

5 COFFEE BOARD
Ministry of Foreign Trade, Post Bag No.5366, Bangalore-1 (Mysore)

Cardamom

6 CARDAMOM BOARD
Directorate of Cardamom Development and Marketing, Mareena Buildings, Mahatma Gandhi Road, Cochin-16(Kerala)

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CORPORATIONS

Food Technology

1 ANDHRA PRADESH STATE AGRO-INDUSTRIES CORPORATION LIMITED
Intekhab Manzil, 10-2-3, A.C.Guard, Hyderabad-4 (A.P.)

2 ASSAM AGRO-INDUSTRIES DEVELOPMENT CORPORATION LIMITED
Gauhati-7 (Assam)

3 BIHAR STATE AGRO-INDUSTRIES DEVELOPMENT CORPORATION LIMITED
Nageshwar Colony, Boring Road, Patna (Bihar)

4 FOOD CORPORATION OF INDIA
1, Bahadur Shah Zafar Marg, New Delhi-1

5 HARYANA AGRO-INDUSTRIES CORPORATION LIMITED
Khoti, No.8, Sector 9-A, Chandigarh

6 KERALA AGRO-INDUSTRIES CORPORATION LIMITED
General Hospital Road, Trivandrum-1 (Kerala)

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7 MAHARASHTRA AGRO-INDUSTRIES DEVELOPMENT CORPORATION LIMITED
Rajan House, 3rd Floor, Near Century Bazar, Bombay-25
(Maharashtra)

8 MYSORE STATE AGRO-INDUSTRIES CORPORATION LIMITED
No.10, Aliaskar Road, Bangalore-18 (Mysore)

9 PUNJAB AGRO-INDUSTRIES CORPORATION LIMITED
167, Sector 19-A, Chandigarh

10 TAMIL NADU AGRO-INDUSTRIES CORPORATION LIMITED
122, Mount Road, P.B.No.4508, Madras-6 (Tamil Nadu)

Food, Storage

11 ASSAM STATE WAREHOUSING CORPORATION
Shillong (Assam)

12 CENTRAL WAREHOUSING CORPORATION
C-90, New Delhi South Extension Part II, New Delhi-49

13 MAHARASHTRA STATE WAREHOUSING CORPORATION
18, Bombay Road, Poona-3 (Maharashtra)

14 TAMIL NADU WAREHOUSING CORPORATION
9/10, Moore Street, Madras-1 (Tamil Nadu)

15 WEST BENGAL STATE WAREHOUSING CORPORATION
45, Ganesh Chandra Avenue, Calcutta-16 (West Bengal)

Cashew

16 KERALA STATE CASHEW DEVELOPMENT CORPORATION LIMITED
Post Box No.13, Quilon (Kerala)

Dairy

17 INDIAN DAIRY CORPORATION
7th Floor, Yashkamal Building, Lokmanya Tilak Road,
Baroda-5, Gujarath.

Fish

18 MYSORE STATE FISHERIES DEVELOPMENT CORPORATION
Government of Mysore, Bangalore (Mysore)

19 STATE FISHERIES DEVELOPMENT CORPORATION LIMITED
Government of West Bengal, Calcutta (West Bengal)

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COUNCILS

Food Technology

1 INDIAN COUNCIL OF AGRICULTURAL RESEARCH
Krishi Bhavan, New Delhi-1

Food, Processed

2 PROCESSED FOODS EXPORT PROMOTION COUNCIL
119, Jor Bagh, New Delhi

Oil and Oilseed

3 INDIAN OIL SEEDS DEVELOPMENT COUNCIL
Telham Bhavan, Himayatnagar, Hyderabad-29(Andhra Pradesh)

Cashew

4 CASHEW DEVELOPMENT COUNCIL
Calicut (Kerala)

5 CASHEW EXPORT PROMOTION COUNCIL
"World Trade Centre", Mahatma Gandhi Road, Ernakulam,
Cochin-16 (Kerala)

Dairy

6 INDIAN DAIRY COUNCIL
New Delhi

Fish

7 MARINE PRODUCTS EXPORT PROMOTION COUNCIL
"World Trade Centre", Mahatma Gandhi Road, Ernakulam,
Cochin-16 (Kerala)

Spice

8 SPICES EXPORT PROMOTION COUNCIL
"World Trade Centre", Mahatma Gandhi Road, Ernakulam,
Cochin-16 (Kerala)

SOCIETIES

Biochemistry

1 SOCIETY OF BIOLOGICAL CHEMISTS (INDIA)
Indian Institute of Science, Bangalore-12 (Mysore)

Food Technology

2 AGRICULTURAL SOCIETY OF MADRAS
18, Cathedral Road, Madras-6 (Tamil Nadu)

3 BIHAR ACADEMY OF AGRICULTURAL SCIENCE
P.O. Sabour, Bhagalpur (Bihar)

4 HORTICULTURAL SOCIETY OF INDIA
255, Upper Palace Orchard, Bangalore-6 (Mysore)

5 INDIAN SOCIETY OF AGRICULTURAL STATISTICS
Library Avenue, P.B.No.310, New Delhi-12

6 INSTITUTION OF AGRICULTURAL TECHNOLOGISTS
Directorate of Agriculture, Seshadri Iyer Road, Bangalore-1 (Mysore)

7 MYSORE HORTICULTURAL SOCIETY
Lal Bagh, Bangalore-4 (Mysore)

8 ROYAL AGRI-HORTICULTURAL SOCIETY OF INDIA
1, Alipore Road, Alipore, Calcutta-27 (West Bengal)

Storage

9 ACADEMY OF PEST CONTROL SCIENCE
Mysore-570013 (Mysore)

Fish

10 SOCIETY OF FISHERIES' TECHNOLOGISTS (INDIA)
C/O Central Institute of Fisheries Technology, Kochangadi, Cochin-5 (Kerala)

Entomology

11 ENTOMOLOGICAL SOCIETY OF INDIA
Indian Agricultural Research Institute, New Delhi-12.

Tropical, Diet

12 TROPICAL DIET RESEARCH SOCIETY
1/6, Fakir Chakravarti Lane, Calcutta-6 (West Bengal)

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INSTITUTIONS

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CFTRI LIBRARY BIBLIOGRAPHICAL SERIES

No. 9

CENTRAL FOOD TECHNOLOGICAL
RESEARCH INSTITUTE
MYSORE-2A, INDIA

PREFACE

Some years ago, the Food and Agriculture Organization of the United Nations brought out a cyclostyled list of institutions dealing with Food Science and Technology, in most of the countries of the world. The list of Indian institutions was found to be somewhat obsolete and very far from complete. A more up-to-date list was compiled at very short notice in the CFTRI Library, and it was included in the second edition of the FAO List in 1966.

Since then, interest in Food Science and Technology has spread to a much wider circle. For example, new departments of Food Technology have been opened in many of the Agricultural Universities; and many more colleges of Home Science are offering master's degree courses in Food and Nutrition. Organizations whose work was previously confined to agriculture and horticulture have begun to evince an interest in the post-harvest handling and processing of their products, while associations of food industries are thinking of sponsoring research in this subject.

The time, therefore, appeared opportune to bring out a comprehensive list of all Indian organizations interested in this field with the exception, however, of individual food manufacturing firms. The Directory of Scientific Research Institutions in India, published by INSDOC in 1969, was the main sources of information.

This list which was compiled by Shri S.B. Chennakashava Das, Asst. Librarian, contains nearly 300 entries, of which 236 are teaching or research institutions, and their field stations. The remaining entries are of associations, boards, corporations, councils and societies which could function as sponsors of research. The entries, consisting of the names and addresses of the institutions or organizations, are arranged subject-wise in alphabetical order, and a subject index is also provided.

It is hoped that the list will prove useful in establishing contacts between food scientists and technologists, as well as in the planning and coordination of research projects.

K.M. Dastur
Chairman,
Library Committee.

Indian Institutions in the field of Food Technology and related Sciences.
(A Classified list)

1972

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Indian Institutions in the field of food
Technology and related Sciences
(A Classified list)
1972

Food Technology

1. BHABHA ATOMIC RESEARCH CENTRE,
   Division of Biochemistry and Food Technology,
   Trombay
   Bombay-74 (Maharashtra)

2. CENTRAL FOOD LABORATORY,
   3, Kyd Street, Calcutta-16 (West Bengal)

3. CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE,
   Mysore-570013

i CFTRI EXPERIMENT STATION
Bhawan's College Campus, Andheri, Bombay-58(AS)
(Maharashtra)

ii CFTRI EXPERIMENT STATION
C-25, Industrial Estate, Sanatnagar, Hyderabad-18
(Andhra Pradesh)

iii CFTRI EXPERIMENT STATION
Pilot plant Building of CDRI, Opposite High Court,
Lucknow-1 (Uttar Pradesh)

iv CFTRI EXPERIMENT STATION
Gill Road, Ludhiana-3 (Punjab)

v CFTRI EXPERIMENT STATION
Gole Bungalow, Nelson Square, Nagpur-1 (Maharashtra)

vi CFTRI FISH TECHNOLOGY EXPERIMENT STATION
Hoige Bazaar, Mangalore (Mysore)

vii CFTRI EXPERIMENT STATION
Krishnadas Nivas, Shoranur Road, Trichur-1 (Kerala)

4. DEFENCE FOOD RESEARCH LABORATORY
   Jyothinagar, Mysore-570010 (Mysore)

5. FOOD CRAFT INSTITUTE
   Government Polytechnic Compound, Ambawadi, Ahmedabad-15
   (Gujarat)

6. FOOD CRAFT INSTITUTE
   S.J. Polytechnic Buildings, Seshadri Road, Bangalore-1
   (Mysore)

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32. REGIONAL RICE RESEARCH STATION
Raha P.O., Nowgong District (Assam)

33 RICE RESEARCH STATION
Ambasamudram, Tirunelveli District (Tamil Nadu)

34 RICE RESEARCH STATION
Chinsurah P.O., Hooghly District (West Bengal)

35 RICE RESEARCH STATION
Jeypore P.O., Koraput District (Orissa)

36 RICE RESEARCH STATION,
Tirukuppam, Tirur P.O., Chingalput District (Tamil Nadu)

Wheat

37 WHEAT RESEARCH SCHEME
P-12/76, Kalyani Town, Kalyani P.O., Nadia District (W.B.)

Millet

38 MILLET RESEARCH STATION
Andhra Pradesh Agricultural University
Peddapuram P.O., East Godavari District (Andhra Pradesh)

39 MILLET RESEARCH STATION
Andhra Pradesh Agricultural University, Podalakur P.O.,
Nellore District (Andhra Pradesh)

40 MILLET RESEARCH STATION
Andhra Pradesh Agricultural University, Kottagraharam,
Vizianagaram-1, Vishakapatnam District (Andhra Pradesh)

Bajra (Pearl Millet)

41 BAJRA RESEARCH SUB-STATION
Vijapur, Aurangabad District (Maharashtra)

Maize

42 MAIZE RESEARCH STATION
Amberpet, Hyderabad-13 (Andhra Pradesh)

Pulse

43 PULSES RESEARCH SUB-STATION
Jayamkondacholapuram, Tiruchi District (Tamil Nadu)

Oil and Oil seeds

44 ALAGAPPA CHETTIAR COLLEGE OF TECHNOLOGY
Division of Oil, Guindy, Madras-25 (Tamil Nadu)

45 BANARAS HINDU UNIVERSITY
Department of Chemical Engineering and Chemical Technology (Oils), Varanasi-5 (Uttar Pradesh).

46 CENTRAL RESEARCH INSTITUTE FOR VILLAGE INDUSTRIES
(Field of research Oils), Khadi and Village Industries Commission, Maganwadi, Wardha (Maharashtra)

47 DELHI UNIVERSITY
Department of Chemistry (Oils), Delhi-7

48 FERGUSON COLLEGE
Department of Chemistry (Oils), Poona, Maharashtra

49 INDIAN INSTITUTE OF SCIENCE
Department of Biochemistry (Fats and Oils), Bangalore-12

50 JAMNALAL BAJAJ CENTRAL RESEARCH INSTITUTE FOR VILLAGE INDUSTRIES
Division of Oil and Soap, Maganwadi P.O. Box 4, Wardha (Maharashtra).

51 JIVAJI INDUSTRIAL RESEARCH LABORATORY
Division of Oils, Gwalior (Madhya Pradesh).

52 LAXMINARAYAN INSTITUTE OF TECHNOLOGY
Division of Oils, Amaravathi Road, Nagpur-1 (Maharashtra)

53 OILSEEDS RESEARCH STATION
Banaras (Uttar Pradesh)

54 OILSEEDS RESEARCH STATION
Belatas (Uttar Pradesh)

55 OILSEEDS RESEARCH STATION
Haripura, Chamba District (Himachal Pradesh)

56 OILSEEDS RESEARCH STATION
Kadiri, Ananthapur District (Andhra Pradesh)

57 OILSEEDS RESEARCH STATION
Ludhiana (Punjab)

58 OILSEEDS RESEARCH STATION
Manund, Mehsana District (Gujarat)

59 OILSEEDS RESEARCH STATION
Mauranipur, Uttar Pradesh

60 OILSEEDS RESEARCH STATION
Mavelikara, Alleppey District (Kerala)

61 OILSEEDS RESEARCH SUB-STATION
Gurgaon (Punjab).

62 OILSEEDS RESEARCH SUB-STATION
Kangra (Punjab).

63 OILSEEDS RESEARCH SUB-STATION
Kapurthala (Punjab)

64 OILSEEDS RESEARCH SUB-STATION
Samrala, Ludhiana District (Punjab)

65 OIL TECHNOLOGICAL RESEARCH INSTITUTE
Anantapur (Andhra Pradesh)

66 OSMANIA UNIVERSITY
Department of Chemical Technology (Oils), Hyderabad-7
(Andhra Pradesh)

67 PROVENTIAL INDUSTRIAL RESEARCH LABORATORY
Division of Oils, Patna-5 (Bihar).

68 REGIONAL RESEARCH CENTRE
Oilseeds and Millets (ICAR), Kanpur (Uttar Pradesh)

69 REGIONAL RESEARCH LABORATORY
Division of Oils and Fats, Hyderabad-9 (Andhra Pradesh)

70 REGIONAL RESEARCH LABORATORY
Division of Oils, Gauhathi, Kamrup District (Assam)

71 SRIRAM INSTITUTE FOR INDUSTRIAL RESEARCH
Division of Oils, 19, University Road, Delhi-7

72 UNIVERSITY COLLEGE
Department of Chemistry (Oils) Punjab University,
Hoshiarpur, Punjab.

73 UNIVERSITY COLLEGE OF SCIENCE AND TECHNOLOGY
Department of Applied chemistry (Oils), 92, Acharya
Prafullachandra Road, Calcutta (West Bengal)

74 UNIVERSITY OF KERALA
Department of Applied Chemistry (Oils), Trivandrum, Kerala

Coconut

75 CENTRAL COCONUT RESEARCH STATION
Kasaragod, Kudlu P.O. (Kerala).

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76 CENTRAL COCONUT RESEARCH STATION
Kayangulam, Ochira P.O. (Kerala)

77 CENTRAL COCONUT RESEARCH STATION
Nileswar, Cannanore District (Kerala)

78 REGIONAL COCONUT RESEARCH STATION
University of Agricultural Sciences, Arasikere (Mysore)

79 REGIONAL COCONUT RESEARCH STATION
Kahikuchi, Azara P.O., Kamrup District (Assam)

80 REGIONAL COCONUT RESEARCH STATION
Kattachalkuzhy P.O., Via Balaramapuram, Neyyattinkara (Kerala)

81 REGIONAL COCONUT RESEARCH STATION
Kumarakom (Kerala)

82 REGIONAL COCONUT RESEARCH STATION
Veppankulam, Thanjavur District (Tamil Nadu)

Arecanut

83 CENTRAL ARECANUT RESEARCH STATION
Vittal P.O. (Mysore)

84 REGIONAL ARECANUT RESEARCH STATION
Hire halli P.O. (Mysore)

85 REGIONAL ARECANUT RESEARCH STATION
Kahikuchi (Assam)

86 REGIONAL ARECANUT RESEARCH STATION
Kannara P.O., Trichur District (Kerala)

87 REGIONAL ARECANUT RESEARCH STATION
Mohitnagar (West Bengal)

88 REGIONAL ARECANUT RESEARCH STATION
Palode (Kerala)

Groundnut

89 GROUNDNUT RESEARCH STATION
Mainpuri (Uttar Pradesh)

90 GROUNDNUT RESEARCH STATION
Masulipatnam, Krishna District (Andhra Pradesh)

91 GROUNDNUT RESEARCH STATION
Pollachi, Coimbatore District (Tamil Nadu)

Cashew

2 CASHEW RESEARCH STATION
Anakkayam, Via Malappuram (Kerala)

3 CASHEW RESEARCH STATION
Andhra Pradesh Agricultural University, Bapatla,
Guntur District (Andhra Pradesh)

4 CASHEW RESEARCH STATION
Kuppnatham P.O., Vridhachalam, South Arcot District
(Tamil Nadu)

5 CENTRAL CASHEWNUT RESEARCH STATION
University of Agricultural Sciences, Ullal P.O.,South
Kanara District (Mysore).

6 REGIONAL CASHEWNUT RESEARCH STATION
Vengurla, Rathnagiri District (Maharashtra)

Potato

97 CENTRAL POTATO RESEARCH INSTITUTE
Simla-1 (Himachal Pradesh)

98 CENTRAL POTATO RESEARCH STATION
Mukteswar (Uttar Pradesh)

99 CENTRAL POTATO RESEARCH STATION
Patna (Bihar)

00 POTATO GOLDEN NEMATODE SCHEME
Arni House, Ootacamund-2, Nilgiris (Tamil Nadu)

Fruit

01 FRUIT RESEARCH FARM
J.N. Krishi Vishwa Vidyalaya, Entkhedi, Bhopal (M.P.)

102 FRUIT RESEARCH STATION
Basti (Uttar Pradesh)

103 FRUIT RESEARCH STATION
Chianki P.O., Palamau, Bihar.

104 FRUIT RESEARCH STATION
Periyakulam, Madhurai District (Tamil Nadu)

105 GOVERNMENT FRUIT RESEARCH STATION
Cape Comorin (Tamil Nadu)

106 GOVERNMENT HILL FRUIT RESEARCH STATION
Chaubattia, P.O., Ranikhet, Almore District (Uttar Pradesh)

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107 POMOLOGICAL STATION
Coonoor, Nilgiris District (Tamil Nadu)

108 REGIONAL FRUIT RESEARCH STATION
Andhra Pradesh Agricultural University, Anantharajupet P.O., Cuddappa District (Andhra Pradesh)

109 REGIONAL FRUIT RESEARCH STATION
Chettalli, Coorg District (Mysore)

110 REGIONAL FRUIT RESEARCH STATION
Mashobra, Simla-7 (Himachal Pradesh).

Citrus

111 GOVERNMENT CITRUS FRUIT RESEARCH STATION
Burnihat (via) K and J District (Assam)

Banana

112 BANANA RESEARCH STATION
Hajipur P.O. (Muzaffarpur) Bihar

113 BANANA RESEARCH STATION
Kovvur P.O., West Godavari District (Andhra Pradesh)

114 BANANA AND PINEAPPLE RESEARCH STATION
Kannara P.O., Trichur District (Kerala)

115 CENTRAL BANANA RESEARCH STATION
Aduthurai P.O., Thanjore District (Tamil Nadu)

Sugar

116 NATIONAL SUGAR INSTITUTE
Kalianpur, Kanpur (Uttar Pradesh)

Starch

117 ANIL STARCH PRODUCTS LIMITED
Anil Road P.O., Box 1062, Ahmedabad (Gujarat)

Dairy

118 COMPOSITE LIVESTOCK FARM AND RESEARCH STATION
Dairy Division, Hessaraghatta, Bangalore North (Mysore)

119 DAIRY SCIENCE COLLEGE
Anand (Gujarat)

120 DAIRY SCIENCE COLLEGE
Karnal (Punjab)

121 GUJARAT COLLEGE OF VETERINARY SCIENCE AND ANIMAL HUSBANDRY
Division of Dairy Science, Near Jaganath Mahadev,
Anand (Gujarat)

122 INDIAN VETERINARY RESEARCH INSTITUTE
Izathnagar (Uttar Pradesh)

123 NATIONAL DAIRY RESEARCH INSTITUTE
Karnal (Haryana)

124 NATIONAL DAIRY RESEARCH INSTITUTE
Southern Regional Station, Adugodi P.O., Hosur Road,
Bangalore-30 (Mysore)

125 NATIONAL DAIRY RESEARCH INSTITUTE
Western Regional Station, Aarey Milk Colony, Bombay-65
(Maharashtra)

126 NATIONAL DAIRY RESEARCH INSTITUTE
Eastern Regional Station, Kalyani (West Bengal)

127 STATE INSTITUTE OF ANIMAL HUSBANDRY AND DAIRYING
Haringhata, Mohanpur P.O., Nadia District (West Bengal)

Poultry

128 POULTRY RESEARCH STATION
Andhra Pradesh Agricultural University, Kakinada Port,
East Godawari District (Andhra Pradesh)

Fish

129 ANDHRA UNIVERSITY
Department of Zoology, Fisheries Division, Waltair
(Andhra Pradesh)

130 ANNAMALAI UNIVERSITY
Department of Zoology, Fisheries Division, Annamalai-
nagar, South Arcot District (Tamil Nadu)

131 BANARAS HINDU UNIVERSITY
Department of Zoology, Division of Fish and Fisheries,
Varanasi-5 (Uttar Pradesh)

132 CENTRAL FISHERIES TECHNOLOGICAL RESEARCH STATION
Cochin (Kerala)

133 CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
Barrakpore P.O. (West Bengal)

134 CENTRAL INSTITUTE OF FISHERIES EDUCATION
P.O.Box 7392, Kakori Camp, J.P.Road, Versova, Bombay-58

135 CENTRAL INSTITUTE OF FISHERIES OPERATIVES
Ernakulam (Kerala)

136 CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
Chittor Road, Ernakulam, Cochin-11 (Kerala)

137 CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
Marine Fisheries P.O., Mandapam Camp (Tamil Nadu)

138 COLLEGE OF FISHERIES SCIENCE
Mangalore (Mysore)

139 DEEP-SEA FISHING STATION
Bombay (Maharashtra)

140 FISHERIES RESEARCH STATION
Pandit Nehru Marg, Jamnagar-1 (Gujarat)

141 FISHERIES TECHNOLOGICAL STATION
West Hill, Kozhikode-5 (Kerala)

142 FISHERIES TECHNOLOGICAL STATION
North Beach Road, Tuticorin-1 (Tamil Nadu)

143 FISHERIES TRAINING INSTITUTE
Bombay (Maharastra)

144 FRESHWATER FISHERIES RESEARCH STATION
Kalyani, West Bengal

145 GAUHATI UNIVERSITY
Department of Zoology, Division of Ichyology
Gauhati University P.O., Gauhati-14 (Assam)

146 HILL-STREAM FISHERIES RESEARCH STATION
Kalimpang, West Bengal

147 INLAND FISHERIES RESEARCH STATION
Bangalore (Mysore)

148 KARNATAK UNIVERSITY
Department of Zoology, Division of Fisheries,
Dharwar-3 (Mysore)

149 MARATHWADA UNIVERSITY
Department of Zoology, Division of Fishery Science,
Aurangabad (Maharashtra)

150 MARINE BIOLOGY LABORATORY AND AQUARIUM
Department of Marine Biology and Oceanography, Division
of Fisheries Technology and Ichthyology, University of
Kerala, Acquarium, Trivandrum-7 (Kerala)

151 MARINE PRODUCTS PROCESSING TRAINING CENTRE
Mangalore (Mysore)

...12

152 NAGAPUR UNIVERSITY
Post-Graduate Teaching, Department of Zoology, Division of Ichthyology, Amaravati Road, Nagapur (Maharashtra)

153 PUNJAB UNIVERSITY
Department of Zoology, Division of Fish and Fisheries, Sector 14, Chandigarh.

154 REGIONAL RESEARCH LABORATORY
Division of Fish Protein and related products, Bhuvaneswara-4 (Orissa)

155 REGIONAL TRAINING CENTRE FOR INLAND FISHER OPERATIONS
Agra (Uttar Pradesh)

156 REGIONAL TRAINING CENTRE FOR INLAND FISHERY OPERATIONS
Hyderabad (Andhra Pradesh)

157 SCHOOL OF STUDIES IN ZOOLOGY
Division of Fish, Vikram University, Kothi Road, Ujjain (Madhya Pradesh)

158 UNIVERSITY OF CALICUT
Department of Fisheries, University P.O., Calicut (Kerala

159 UNIVERSITY OF RAJASTHAN
Department of Zoology, Division of Fishery Biology, Jaipur-4 (Rajasthan)

Tea

160 TEA RESEARCH ASSOCIATION
Tocklai Experimental Station, Jorhat-8 (Assam)

161 UPASI TEA CLONAL CENTRE
Coonoor, Nilgiris (Tamil Nadu)

162 UPASI TEA RESEARCH STATION
Cinchona P.O., Coimbatore District (Tamil Nadu)

163 UPASI TEA RESEARCH SUB-STATION
Vandiperiyar P.O. (Kerala)

Coffee

164 CENTRAL COFFEE RESEARCH INSTITUTE
Coffee Board, Research Department, Coffee Research Station P.O., Chickamagalore District (Mysore)

Toddy (Neera)

165 CENTRAL RESEARCH CUM TRAINING CENTRE
Field of Research (Neera) Dahanu (Maharashtra)

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Spice

166 REGIONAL SPICES RESEARCH STATION
Appangala (Mysore)

Sesamum (Gingelly, Niger, Caster, Toria)

167 SESAMUM RESEARCH STATION
Karimnagar, Andhra Pradesh.

168 SESAMUM RESEARCH STATION
Yellamanchili, Vishakapatnam District, Andhra Pradesh.

169 GINGELLY RESEARCH STATION
30, South Agraharam, Karur, Tiruchirapalli District (Tamil Nadu)

170 NIGER RESEARCH STATION
Hosur, Salem District (Tamil Nadu)

171 CASTER RESEARCH STATION
Sanyasigundu Road, Kichipalyam, Salem-1 (Tamil Nadu)

172 TORIA RESEARCH STATION
Rudrapur (Uttar Pradesh)

Pepper

173 MINOR RESEARCH STATION-PEPPER
University of Agricultural Sciences, Sirsi, North Kanara District (Mysore)

174 PEPPER RESEARCH STATION
Taliparamba, Cannanore District (Kerala)

Chillies

175 REGIONAL RESEARCH STATION
Co-ordinated Chillies Scheme, Kovilpatti, Tirunelveli District (Tamil Nadu)

Cardamom

176 CARDAMOM RESEARCH STATION
Pampadumpara P.O., via Vandanmettu, Kottayam District (Kerala)

Entomology

177 ANNAMALAI UNIVERSITY
Department of Zoology, Entomology Division, Annamalainagar, South Arcot District (Tamil Nadu)

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178 BANARAS HINDU UNIVERSITY
Department of Zoology, Division of Entomology, Varanasi-5 (Uttar Pradesh)

179 GAUHATI UNIVERSITY
Department of Zoology, Division of Entomology, Gauhati University P.O., Gauhati-14 (Assam)

180 KARNATAK UNIVERSITY
Department of Zoology, Division of Entomology, Dharwar-3 (Mysore)

181 NAGPUR UNIVERSITY
Post-Graduate Teaching, Department of Zoology, Division of Entomology, Amaravathi Road, Nagpur, Maharashtra.

182 PUNJAB UNIVERSITY
Department of Zoology, Division of Entomology, Sector-14 Chandigarh

Bee

183 CENTRAL BEE RESEARCH AND TRAINING INSTITUTE
839/1, Shivajinagar, Poona-5 (Maharashtra)

Nutrition

184 ALL INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH
Division of Biochemistry and Nutrition, 110, Chittaranjan Avenue, Calcutta (West Bengal)

185 BENGAL IMMUNITY RESEARCH INSTITUTE
Division of Biochemistry and Nutrition, 39, Acharyya Jagadish Bose Road, Calcutta-17 (West Bengal)

186 HAFFKINE INSTITUTE
Biochemistry and Nutrition Division, Acharya Donde Marg, Parel, Bombay-12 (Maharashtra)

187 LUCKNOW UNIVERSITY
Department of Biochemistry (Nutrition), Lucknow (U.P.)

188 NATIONAL INSTITUTE OF NUTRITION
Tarnaka, Hyderabad-7 (Andhra Pradesh)

189 PUBLIC HEALTH INSTITUTE
Division of Nutrition and Biochemistry, Patna-4(Bihar)

190 PUBLIC HEALTH LABORATORY
Nutrition Division, Red Cross Road, Trivandrum-1 (Kerala)

191 RAPTAKOS BRETT AND COMPANY PRIVATE LIMITED
Research and Control Division (Nutrition), 47,Dr.Annie Besant Road, Worli, Bombay-18 (Maharashtra)

192 WILSON COLLEGE
Department of Biochemistry (Egg proteins, Protein malnutrition), Bombay-7 (Maharashtra)

Packaging

193 INDIAN INSTITUTE OF PACKAGING
254-C, Dr.Annie Besant Road, Prabhadevi, Bombay-25 (Maharashtra)

194 INDIAN INSTITUTE OF PACKAGING
51, Sir Thyagaraya Road, Madras-17 (Tamil Nadu)

195 METAL BOX COMPANY OF INDIA LIMITED
Research Department, 92/1, Alipore Road, Calcutta-27 (West Bengal)

196 METAL BOX OF INDIA LIMITED
Tower Yard, Tower Road, Fort, Cochin (Kerala)

197 METAL BOX COMPANY OF INDIA
249, Worli Road, Bombay-18WB, Maharashtra

198 METAL BOX COMPANY OF INDIA LIMITED
Link House, Mathura Road, New Delhi-1

199 METAL BOX COMPANY OF INDIA LIMITED
Elaiya Mudali Street, Thondiarpet, Madras-21 (Tamil Nadu)

Home Science

200 CENTRAL INSTITUTE OF HOME SCIENCE
Bangalore University, Bangalore (Mysore)

201 COLLEGE OF HOME SCIENCE (Bombay and Poona)
S.N.D.T. Women's University, 1, Nathibai Thackersey Road, Maharshi Karve Road, Bombay-2A (Maharashtra)

202 COLLEGE OF HOME SCIENCE
University of Bombay, Nirmala Niketan, 38, New Marine Lines, Bombay-20 (Maharashtra)

203 COLLEGE OF HOME SCIENCE
Andhra Pradesh Agricultural University, Hyderabad-4 (A.P.)

204 COLLEGE OF HOME SCIENCE
Punjab Agricultural University, Ludhiana, Punjab.

205 COLLEGE OF HOME SCIENCE
University of Udaipur, Udaipur (Rajasthan)

206 LADY IRWIN COLLEGE
Delhi University, Department of Foods and Nutrition, Sikandra Road, New Delhi.

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207 M.N. COLLEGE OF HOME SCIENCE FOR WOMEN
Division of Foods and Nutrition, University of Jabalpur, Jabalpur (Madhya Pradesh)

208 MAHARAJA SAYYAJIRAO UNIVERSITY OF BARODA
Faculty of Home Science, Department of Foods and Nutrition, Baroda (Gujarat)

209 QUEEN MARY'S COLLEGE
Department of Home Science, Madras University, Madras.(TN)

210 SIET WOMEN'S COLLEGE
Department of Home Science, Madras University, Madras.(T.N)

211 SRI AVINASHILINGAM HOME SCIENCE COLLEGE
Department of Foods and Nutrition, Coimbatore-11 (T.N.)

212 SRI PADMAVATHY COLLEGE FOR WOMEN
Department of Home Science, Sri Venkateshwara University, Thirupathi (Andhra Pradesh)

213 ST. THERESA COLLEGE
Department of Home Science, Kerala University, Ernakulam Cochin (Kerala)

214 UNIVERSITY OF ALLAHABAD
Department of Home Science, Allahabad (Uttar Pradesh)

215 UNIVERSITY OF KERALA
Department of Home Science, Trivandrum (Kerala)

216 UNIVERSITY OF MYSORE
Department of Home Science, Division of Foods and Nutrition, Manasa Gangothri, Mysore-570006 (Mysore)

217 WOMEN'S CHRISTIAN COLLEGE
Department of Home Science, Foods and Nutrition Division, Madras University, Nungambakkam, Madras (Tamil Nadu)

Hotel Science

218 INSTITUTE OF CATERING TECHNOLOGY AND APPLIED NUTRITION
Ministry of Food and Agriculture, Sawarkar Marg, Bombay-28 (Maharashtra)

219 INSTITUTE OF CATERING TECHNOLOGY AND APPLIED NUTRITION
21, Convent Road, Calcutta-14 (West Bengal)

220 INSTITUTE OF CATERING TECHNOLOGY AND APPLIED NUTRITION
Adyar, Madras-20 (Tamil Nadu)

221 INSTITUTE OF HOTEL MANAGEMENT, CATERING AND NUTRITION
Pusa Institute, New Delhi-12.

Food Technology, Education
(Agricultural University)

222 ANDHRA PRADESH AGRICULTURAL UNIVERSITY
Dilkusha, Hyderabad, Andhra Pradesh.

223 ASSAM AGRICULTURAL UNIVERSITY
Jorhat-4 (Assam)

224 HARYANA AGRICULTURAL UNIVERSITY
Hissar (Haryana)

225 JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA
Jabbalpur (Madhya Pradesh)

226 KERALA AGRICULTURAL UNIVERSITY
Mannuthy, Trichur District (Kerala)

227 MAHATMA PHULE KRISHI VIDYAPEETH
Rahauri, Ahmednagar District (Maharashtra)

228 ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
Bhubaneswar (Orissa)

229 PUNJAB AGRICULTURAL UNIVERSITY
Ludhiana (Punjab)

230 PUNJABRAO KRISHI VIDYAPEETH
Krishi Nagar, Akola (Maharashtra)

231 RAJENDRA AGRICULTURAL UNIVERSITY
Patna (Bihar)

232 TAMILNADU AGRICULTURAL UNIVERSITY
Coimbatore-3 (Tamil Nadu)

233 UNIVERSITY OF AGRICULTURAL SCIENCES
Bangalore-24 (Mysore)

234 UNIVERSITY OF KALYANI
P.O.Kalyani, Nadia District (West Bengal)

235 UNIVERSITY OF UDAIPUR
Udaipur (Rajasthan)

236 UTTAR PRADESH AGRICULTURAL UNIVERSITY
Pantnagar, Nainital District (Uttar Pradesh)

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ASSOCIATIONS

Chemical Sciences

1 TECHNOLOGICAL ASSOCIATION
Department of Chemical Technology, Matunga Road,
Bombay-19 (Maharashtra)

Chemical Engineering

2 CHEMICAL ENGINEERING ASSOCIATION
Indian Institute of Science, Bangalore-12 (Mysore)

3 INDIAN INSTITUTE OF CHEMICAL ENGINEERS
Jadhavpur University Campus, Calcutta-32 (West Bengal)

Food Technology

4 ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (India)
Mysore-570013 (Mysore)

5 ASSOCIATION OF PLANTERS OF TAMIL NADU
"CANOWIE", Coonoor, Nilgiri District (Tamil Nadu)

6 SOUTH INDIA HORTICULTURAL ASSOCIATION
Lawley Road, Coimbatore (Tamil Nadu)

7 UNITED PLANTERS ASSOCIATION OF SOUTHERN INDIA
P.O.Box No.11, "Glenview", Coonoor, Nilgiri District.
(Tamil Nadu)

Milling

8 ROLLER FLOUR MILLERS' FEDERATION OF INDIA
438, Mathura Road, Jangpura, New Delhi-14

Preservation

9 ALL INDIA FOOD PRESERVERS' ASSOCIATION
Hindusthan Lever House, Backbay Reclamation,
Bombay-1 (Maharashtra)

Storage

10 WEST BENGAL COLD STORAGE ASSOCIATION
795, Mahatma Gandhi Road, Calcutta-7 (West Bengal)

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Protein

11 PROTEIN FOODS ASSOCIATION OF INDIA
Mahalakshmi Chambers, 22, Bhulabhai Desai Road,
Bombay-26 (Maharashtra)

Cereal

12 FOODGRAIN TECHNOLOGISTS' RESEARCH ASSOCIATION OF INDIA
P.O.Box No.10, Meerut Road, Hapur (Uttar Pradesh)

Rice

13 ASSOCIATION OF RICE RESEARCH WORKERS (Cuttack)

Cottenseed, Crushing

14 ALL INDIA COTTONSEED CRUSHERS ASSOCIATION
198, J.Tata Road, Bombay-20 (Maharashtra)

Oil and Oilseed

15 ALLEPPEY OIL MILLERS' AND MERCHANTS' ASSOCIATION
Naga Mahal Buildings, Alleppey (Kerala)

16 ANDHRA PRADESH OIL MILLERS ASSOCIATION
Kishanganj, Hyderabad (Andhra Pradesh)

17 BOMBAY OILSEED CRUSHERS' ASSOCIATION
Anna Bhavan, Broach Street, Bombay-9 (Maharashtra)

18 EAST INDIA OIL MILLERS' ASSOCIATION
State Bank Building (Burrabazar Branch), 195, Mahatma
Gandhi Road, Calcutta-7 (West Bengal)

19 OIL TECHNOLOGISTS ASSOCIATION OF INDIA
Nawabganj, Kanpur (Uttar Pradesh)

20 TRAVANCORE OIL MILLERS' ASSOCIATION
Naga Mahal, Alleppey (Kerala)

Sugar

21 SUGAR TECHNOLOGISTS' ASSOCIATION OF INDIA
P.O. Kalyanpur, Kanpur (Uttar Pradesh)

Dairy

22 INDIAN DAIRY SCIENCE ASSOCIATION
E-6, South Extension, Part II, New Delhi-49

Seafood, Canning

23 SEAFOOD CANNERS' AND FREEZERS' ASSOCIATION OF INDIA
Cochin Company Buildings, XIX/5, Kochangadi, Cochin-5
(Kerala)

Fish

24 MARINE BIOLOGICAL ASSOCIATION
Mandapam Camp, Tamil Nadu.

Tea

25 INDIAN TEA PLANTERS' ASSOCIATION
Post Box No.74, Jalapaiguri (West Bengal)

Tea, Packing

26 TEA PACKETERS ASSOCIATION OF INDIA
P-32/33, India Exchange Place, Calcutta (West Bengal)

Microbiology

27 ASSOCIATION OF MICROBIOLOGISTS OF INDIA
P-27, Princep Street, Calcutta-13 (West Bengal)

Bee

28 ALL INDIA BEE-KEEPERS' ASSOCIATION
424/13, Shaniwar Peth, Poona-2 (Maharashtra)

Home Science

29 ALL INDIA HOME SCIENCE ASSOCIATION OF INDIA
Viharilal College of Home Science, Calcutta (West Bengal

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BOARDS

Food Technology

1 FOOD AND NUTRITION BOARD
Ministry of Food and Agriculture, Krishi Bhavan,
New Delhi.

Dairy

2 NATIONAL DAIRY DEVELOPMENT BOARD
Anand (Gujarath)

Fish

3 CENTRAL BOARD OF FISHERIES
New Delhi

Tea

4 TEA BOARD
27 & 29, Brabourne Road, Calcutta-1(West Bengal)

Coffee

5 COFFEE BOARD
Ministry of Foreign Trade, Post Bag No.5366, Bangalore-1 (Mysore)

Cardamom

6 CARDAMOM BOARD
Directorate of Cardamom Development and Marketing,
Mareena Buildings, Mahatma Gandhi Road, Cochin-16(Kerala)

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CORPORATIONS

Food Technology

1 ANDHRA PRADESH STATE AGRO-INDUSTRIES CORPORATION LIMITED
Intekhab Manzil, 10-2-3, A.C.Guard, Hyderabad-4 (A.P.)

2 ASSAM AGRO-INDUSTRIES DEVELOPMENT CORPORATION LIMITED
Gauhati-7 (Assam)

3 BIHAR STATE AGRO-INDUSTRIES DEVELOPMENT CORPORATION LIMITED
Nageshwar Colony, Boring Road, Patna (Bihar)

4 FOOD CORPORATION OF INDIA
1, Bahadur Shah Zafar Marg, New Delhi-1

5 HARYANA AGRO-INDUSTRIES CORPORATION LIMITED
Khoti, No.8, Sector 9-A, Chandigarh

6 KERALA AGRO-INDUSTRIES CORPORATION LIMITED
General Hospital Road, Trivandrum-1 (Kerala)

7 MAHARASHTRA AGRO-INDUSTRIES DEVELOPMENT CORPORATION LIMITED
Rajan House, 3rd Floor, Near Century Bazar, Bombay-25
(Maharashtra)

8 MYSORE STATE AGRO-INDUSTRIES CORPORATION LIMITED
No.10, Aliaskar Road, Bangalore-18 (Mysore)

9 PUNJAB AGRO-INDUSTRIES CORPORATION LIMITED
167, Sector 19-A, Chandigarh

10 TAMIL NADU AGRO-INDUSTRIES CORPORATION LIMITED
122, Mount Road, P.B.No.4508, Madras-6 (Tamil Nadu)

Food, Storage

11 ASSAM STATE WAREHOUSING CORPORATION
Shillong (Assam)

12 CENTRAL WAREHOUSING CORPORATION
C-90, New Delhi South Extension Part II, New Delhi-49

13 MAHARASHTRA STATE WAREHOUSING CORPORATION
18, Bombay Road, Poona-3 (Maharashtra)

14 TAMIL NADU WAREHOUSING CORPORATION
9/10, Moore Street, Madras-1 (Tamil Nadu)

15 WEST BENGAL STATE WAREHOUSING CORPORATION
45, Ganesh Chandra Avenue, Calcutta-16 (West Bengal)

Cashew

16 KERALA STATE CASHEW DEVELOPMENT CORPORATION LIMITED
Post Box No.13, Quilon (Kerala)

Dairy

17 INDIAN DAIRY CORPORATION
7th Floor, Yashkamal Building, Lokmanya Tilak Road,
Baroda-5, Gujarath.

Fish

18 MYSORE STATE FISHERIES DEVELOPMENT CORPORATION
Government of Mysore, Bangalore (Mysore)

19 STATE FISHERIES DEVELOPMENT CORPORATION LIMITED
Government of West Bengal, Calcutta (West Bengal)

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COUNCILS

Food Technology

INDIAN COUNCIL OF AGRICULTURAL RESEARCH
Krishi Bhavan, New Delhi-1

Food, Processed

2 PROCESSED FOODS EXPORT PROMOTION COUNCIL
119, Jor Bagh, New Delhi

Oil and Oilseed

3 INDIAN OIL SEEDS DEVELOPMENT COUNCIL
Telham Bhavan, Himayatnagar, Hyderabad-29 (Andhra Pradesh)

Cashew

4 CASHEW DEVELOPMENT COUNCIL
Calicut (Kerala)

5 CASHEW EXPORT PROMOTION COUNCIL
"World Trade Centre", Mahatma Gandhi Road, Ernakulam, Cochin-16 (Kerala)

Dairy

6 INDIAN DAIRY COUNCIL
New Delhi

Fish

7 MARINE PRODUCTS EXPORT PROMOTION COUNCIL
"World Trade Centre", Mahatma Gandhi Road, Ernakulam, Cochin-16 (Kerala)

Spice

8 SPICES EXPORT PROMOTION COUNCIL
"World Trade Centre", Mahatma Gandhi Road, Ernakulam, Cochin-16 (Kerala)

SOCIETIES

Biochemistry

1 SOCIETY OF BIOLOGICAL CHEMISTS (INDIA)
Indian Institute of Science, Bangalore-12 (Mysore)

2..

Food Technology

2 AGRICULTURAL SOCIETY OF MADRAS
18, Cathedral Road, Madras-6 (Tamil Nadu)

3 BIHAR ACADEMY OF AGRICULTURAL SCIENCE
P.O. Sabour, Bhagalpur (Bihar)

4 HORTICULTURAL SOCIETY OF INDIA
255, Upper Palace Orchard, Bangalore-6 (Mysore)

5 INDIAN SOCIETY OF AGRICULTURAL STATISTICS
Library Avenue, P.B.No.310, New Delhi-12

6 INSTITUTION OF AGRICULTURAL TECHNOLOGISTS
Directorate of Agriculture, Seshadri Iyer Road,
Bangalore-1 (Mysore)

7 MYSORE HORTICULTURAL SOCIETY
Lal Bagh, Bangalore-4 (Mysore)

8 ROYAL AGRI-HORTICULTURAL SOCIETY OF INDIA
1, Alipore Road, Alipore, Calcutta-27 (West Bengal)

Storage

9 ACADEMY OF PEST CONTROL SCIENCE
Mysore-570013 (Mysore)

Fish

10 SOCIETY OF FISHERIES' TECHNOLOGISTS (INDIA)
C/O Central Institute of Fisheries Technology,
Kochangadi, Cochin-5 (Kerala)

Entomology

11 ENTOMOLOGICAL SOCIETY OF INDIA
Indian Agricultural Research Institute, New Delhi-12.

Tropical, Diet

12 TROPICAL DIET RESEARCH SOCIETY
1/6, Fakir Chakravarti Lane, Calcutta-6 (West Bengal)

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INSTITUTIONS

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